A Diſcourſe of Naturall
BATHES,
And Minerall
VVATERS.

Wherein firſt the originall of Fountaines
in generall, is declared.

Then the nature and differences of Minerals, with examples of particular Bathes from moſt of them.

Next the generation of Minerals in the earth, from whence
both the actuall heat of Bathes, and their vertues
are proued to proceed.

Alſo by what meanes Minerall Waters are to bee examined and diſcouered.

And laſtly, of the nature and vſes of Bathes,
but eſpecially of our Bathes at BATHE
in Sommerſet-ſhire.

The ſecond Edition in many points enlarged.

By ED. IORDEN, D^{r}. *in Phyſick.*

LONDON,
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MUNIFICENTIA REGIA 1715
GEORGIUS D.G. MAG. BRIT. FR. ET HIB. REX F.D.
J. Pine
sculp

TO THE RIGHT HONORABLE, FRANCIS Lord COTTINGTON, Baron of *Hanworth*, Chancellour of the Exchequer, and one of his Maieſties moſt honorable Priuy Councell.

THE profitable vſe of Bathes, both for neceſſity and comfort, is ſuch, and ſo well confirmed from all antiquity, as I need not labour to illuſtrate it more; only it hath beene the ill hap of our Country Bathes to ly more obſcure then any other throughout Chriſtendome, although they deſerue as well as the beſt, becauſe very few haue written any thing of them, and they haue either not mentioned, or but ſlightly paſſed ouer the maine points concerning their cauſes and originals; contenting themſelues with an empiricall vſe of them. This hath made me, through the inſtigation alſo of ſome of my worthy friends, to attempt ſomewhat in this kinde: which if it giue not ſatisfaction according to my deſire, yet it may be a prouocation to ſome others, to perfect that which I haue begun. And ſeeing I doe it for the vſe of my Country, I haue neglected curious ornaments to garniſh it withall, but haue clad it in a plaine ſuit of our Country Cloath; without welt or gard: not deſiring it ſhould ſhew it ſelfe in forrain parts: *Mea cymba legat littus*.

But in this mine vndertaking, I finde my ſelfe expoſed to many cenſures, both concerning ſome paradoxicall opinions in Philoſophy, which notwithſtanding I deliuer not *gratis*, but confirmed with good grounds of reaſon and authorities: as alſo concerning the reformation of our Bathes, which doe daily ſuffer many indignities more wayes then I haue mentioned, vnder the tyranny of ignorance, impoſture, priuate reſpects, wants, factions, diſorder, &c. ſo as they are not able to diſplay their vertues, and doe that good for which God hath ſent them to vs: and all for want of ſuch good gouernment as other Bathes do enioy. I blame not our City herein, vnto whoſe care the ordering of theſe Bathes is committed, the diſorders and defects being ſuch as are out of their verge, and neither in their power, nor in their knowledge to redreſſe. For they haue ſufficiently teſtified their deſire of reforming all ſuch abuſes, when they voluntarily did ioyne in petitioning the late King *Iames* of bleſſed memory, to that end: by whoſe death this petition alſo died. And they knew well that it muſt be ſuperior power that muſt effect it. In theſe reſpects I haue need of ſome noble and eminent Patron to protect both mee and my Bathes, whoſe cauſe I take vpon me to plead, and to aduance, according to their due deſert: but eſpecially for the Bathes ſake, which I deſire may floriſh to the vtmoſt extent of benefit to the people; and to haue all impediments remoued out of their way, which may hinder them in the progreſſe of their vertues. This is the cauſe Sir, why I preſume to dedicate theſe my labours to your Honour, who hauing obſerued in forraine parts, the vſes and gouernments of all ſorts, and being both by the fauour of his Maieſty well able, and by your noble diſpoſition well inclined and willing to maintaine good order and diſcipline, will, I doubt not, excuſe this boldneſſe, and pardon my preſumption. Conſider Sir, that this is your natiue Country, which naturally euery man doth affect to aduance, and theſe Bathes are the principall Iewels of your Country, & able to make it more famous

then

then any other parts of this Kingdome, and in aduancing them, to aduance your name to all poſterity. Wherefore howſoeuer my ſelfe deſerue but ſmall reſpect from you, yet I beſeech you reſpect the Bathes of your Country, and me as a welwiſher vnto them.

And as the common opinion of your great worth and abilities, haue moued mee to this boldneſſe, ſo the particular fauors of your Noble Lady, and the encouragement of your learned Phyſitian, Maſter, Doctor *Baſkeruill*, mine eſpeciall friend, who hath ſpurred mee on to this work, haue remoued out of my minde all ſuſpition of miſconſtruction. But that as mine intent hath beene meerely the enlarging of the knowledge of thoſe points concerning Bathes, and more eſpecially of our Bathes in Sommerſetſhire; ſo you will bee pleaſed to accept of this publique inuitation by mee to doe your Country good, and your ſelfe honor, which I wiſh may neuer be diſioyned. And to mee it will bee no ſmall encouragement to deuote my ſelfe and my beſt endeauours to your ſeruice. So I humbly take my leaue this *23: Aprilis*, 1632.

Your Lordſhips moſt humble ſeruant,

ED. IORDEN

Libellum iſtum DE AQVIS MEDICATIS *à Doctiſsimo* IORDANO *antiquiſſimo Collega noſtro ſcriptum multiplici eruditione & novarum ſubtilitatum varia ſupellectile refertiſsimum, legimus, & qui ab omnibus tam Philoſophis quam Medicis legatur digniſsimum iudicavimus.*

IOHANNES ARGENT *Collegij Medicorum*
Londinenſium Præſidens.

IOHANNES GIFFORD.
SIMON BASKERVILLE.
THOMAS RIDGELEY.

In laudem operis.

Parve alacri paſſu liber, Liber, ibis in orbem;
Denteſque ſpernes lividos.
Authores pandit, ſua dat, Iordanus, & uſu
Quæſita multo protulit.
Aëra qui totus, flammas meditatur, & undas,
Terram, metalla diſcutit.
Quicquid in his veteres, docuit quicquid Novus Author,
Celeri notavit pollice.
At ſua dum exponit, lucem dat, operta recludit,
Pennâque fertur liberâ.
Perge liber; gratus gratum volveris in ævum,
Lymphæ calentes dum fluent.

Ed. Lapworth, M.D.

In laudem Authoris:

Numine divino Iordan *medicabile flumen*
Dicitur, è gelido licèt illud frigore conſtet:
Tu Iordane *decus Medicorum, candide Doctor,*
Lumine divino gnarus diſcernere cauſas
Ægris corporibus nôſti depellere morbos;
Intima ſecluſæ penetrâſti viſcera terræ,
Thermarum vires aperis, reſeraſque metalla:
De gremio telluris aquas manare calentes
Quæ ratione doces, nobis priùs abdita pandis
Scrutando Phyſices arcana indagine mira,
Nec caperis famâ, nec inani laudis amore,
Vt patriæ proſis, dignaris promere lucem:
Qui memoraverunt, vel qui modò Balnea tractant,
Non ſunt te meliùs meriti, vel indice Momo.

Io. Dauntſey.

Ad Authorem.

SI fælix rerum potuit qui noſcere cauſas,
Inter fælices tu prope primus eris.
Sunt quæcunq; tulit vel terra, vel unda, vel aër,
Singula nota tibi, ſingula certa tibi.
Omnigenæ tibi venæ reperta, reſecta metalli,
Nullaq; te in quovis corpore vena latet.
Non tu nominibus veterum terreris, ut umbris,
Nec tibi, ceu multis, quæ nova ſola placent.
Et doctâ & iuſtâ rationis ſingula lance
Libras, quæ veteres quæq; tulêre novi.
Nec cauſas tantum ſcrutans tu negligis uſum:
Vtilis eſt libri pagina quæque tui.
Hoc unum doleo, quod non ſint Anglica noſtra
Balnea, per calamum facta Latina tuum:
Creſceret ut gentis per te ſic gloria noſtra
In longos celebris per loca cuncta dies.

COme hither Reader, bathe thy tender eyes
In *Iordans* ſtreames which out of *Bathe* do riſe,
They'l cleare thy ſight, and make thee cleerly ſee
Choice ſecrets, which in earths deep boſome be
Cloſely laid vp, and choicely ſecret kept,
Where vnobſeru'd they many ages ſlept.
Here come and bathe in *Iordans* ſtreames thy minde,
Thou there a ſtrange yet certaine cure ſhalt finde
Of old ore-ſpreading errors leproſie,
Which theſe cleare ſtreames do ſweetly mundifie:
Here are two miracles of nature met,
Here are two miracles of *England* ſet;

Our Engliſh Bathes, our Engliſh *Iordans* ſtreames
Are gathered here as natures choyceſt creames,
Produc'd by her, by learned Art refin'd
For th' vniuerſall good of humane kinde.
May much good hence be rayſ'd, and may it rayſe
As well firſt Authors as Inuentors praiſe.

Nicol. Stoughton, of Stoughton, Eſquire.

BIs duas gaudes numerare cauſas
(Nam tot authores varij dederunt)
Vnde Thermarum calor ortum haberet
(candide Doctor.)
Tu tenax, nulli, tamen acquieſcis
Ex ijs cauſis: mihi dic (amice)
Cur tibi ſoli via ſingularis
perplacet iſta?
Arrogans forſan nimis ipſe multis
Qui viam linquis, videare, tritam:
Zoili & nigro vocitere vanus
ore Philautus.
Sed cui candor tuus innoteſcit,
Qui tuos mores benè novit; is te
Litis oſorem vocet, & ſerenæ
pacis amantem.
Sint licet Plato Socrateſq; amici,
Tu licet doctos verearis omnes,
Veritas maior tamen eſt amica,
quæ tibi cordi eſt.

Rob. Pierce Bach. in Theologia.

To the Author.

SHall I preſume to write in praiſe of him
Whoſe work hath taught the world more wit and Art,
And ſhall I not mine owne diſpraiſe begin,
To vndertake and cannot reach in part
His worth, his wit, his learning, which confounds
Graue Ancients in their long tradition grounds?
Celſus could brag *Homunculos* to make
Man to preſerue a thouſand yeeres or more,
Yet on himſelfe he did ſo much miſtake,
He could not hold his life till full threeſcore:
Before he made, his maker him did marre,
In this his words and works came ſhort by farre.
But modeſt *Iorden* void of theſe conceits,
Hath clear'd obſcureſt points from darkneſſe foule,
His learning, iudgement, body, ſoule, all waites
Life to preſerue in all; his lifes chiefe ſoule
Being learning, knowledge, and the loue of truth,
He hath made men, himſelfe perpetuall youth.

I. St.

AGes in former doubtfull errors night
From many worthy Starres haue borrowed light.
Our Sunne adornes our dayes, whoſe radiant beames
No heat, but truth adde to our bathing ſtreames.
A fit work for an Artiſt, whoſe pen bleeds
To death-receiu'd opinions: ſhewes the ſeeds
Of earth-intombed Minerals, which lend
Heat by their birth to fountaine Nymphs, who ſpend
Their pious teares in pity to regaine
Strength to the frozen nerues, ſweet eaſe from paine.
Who would not ſtriue to celebrate that quill,
Which doth no fretting gall, but milke diſtill
To foſter truth; being ſo conciſe and terſe,
For to compriſe the Protean vniuerſe
In this ſmall volume: which who diſapproue,
Snarling expreſſe neglect of lending loue
To learning, tenant in this worthy pile,
Where natures works are poliſh'd by Arts file.
Tis ſtrange in dayes of ruffling impudence,
Which pamphlets ſpue of faction fearing ſenſe,
Art ſhould be baſhfull: if you ſearch, you'l meet
It vail'd in each page, ſhrouded in each ſheet;
Aſham'd of their rude folly, whoſe mouthes ſwell
To ſlander worth they nere ſhall parallell.
Ile venture natures tell-tale him to call,
And iudge my verdict's not apocryphall.
Heauen and earth ſeldome ſuch conceald births ſteale,
But he the cauſe can publiſh, meanes reueale.
Take then a true ſuruey, his lines diſcry,
More truſted fables, then the truth did try;
And pay *Machaon* as a friendly ſee
For purging of diſeaſ'd Philoſophy,
The tribute of thy praiſe, though folly fret,
Such as it made wiſe will repay the debt.
Purge foule mouthes (Bathe) that all applaud his pains,
Who purgeth bodies, and refines the braines.

OF NATVRALL BATHES, AND MINERALL WATERS.

Cap. I:

Explication of the word Bathe. The ſcope and argument of this Booke. The ancient vſe and eſteeme of Bathes among the Romans. The moderne vſe of them among the Turkes. Of medicinable Bathes, and minerall Waters. How eſteemed by Greekes, Latines, Arabians, & other nations.

THE word *Bathe* or *Balneum* is of larger extent then I purpoſe to diſcourſe of: for it being the name of a forme of remedie applied to the body, it may be framed either out of liquid things, or ſolid ſubſtances, or vapours.

Liquid Subſtances are Water, Milke, Muſt, Wine, Oyle: ſollid ſubſtances are Sand, Salt, preſſed Grapes, Corne,&c. vapours are Stuffes and hot houſes.

My intent is onely to treate of waters, and principally of thoſe which be called Minerall, whether they bee vſed in Bath or in Potion, &c.

Theſe kinde of watry and vaporous Bathes haue been in vſe from all antiquity, and held in great eſteeme, both for pleaſure, and for preſeruation of health. For there is no forme of remedy more comfortable to mans body, or which eaſeth paine and wearineſſe more ſpeedily, and more effectually. And whereas *Hyppocrates* commends thoſe remedies which doe cure *citò, tutò, & iucundè*, ſpeedily, ſafely, and with comfort; theſe Bathes performe all theſe intentions: and beſides, may be vſed to all ſexes and ages, and temperatures, without hurt or inconuenience, inſomuch as the ancient Romans had them in very frequent vſe: their diet being liberall, and vpon variety of meates, eſpecially vpon Lettice, Coleworts, Aſparagus, raw fruits, and ſuch like, which bred crude humours in their bodies, and had need of ſome ſuch helpe to digeſt them: as *Columella* ſaith, *quotidianam cruditatem laconicis excoqnimus*: we concoct our crudities by the vſe of Bathes. We reade in *Plynie*, that *Agrippa* built in *Rome* 170. publike Bathes for common vſe, and *Pancirollus* tels vs of 856. in *Rome* at one time, and all of them moſt ſumptuous and magnificent buildings, eſpecially the *Anthonin* and *Diocleſian* Bathes: the walles whereof were of admirable height, with an infinite number of marble Pillars, erected for oſtentation, and not to ſupport any thing, 1000. Seates to ſit in; Their *Caldaria, Tepidaria, Frigidaria*, moſt ſumptuous and ſtately: the whole fabricke ſo large and ſpacious, as they reſembled rather Cities then Houſes: And ſo it might well be, when as there were imployed

De deperditis pag.164.

for the building of the *Diocleſian* Bathes, as *Baccius* ſaith. 40000. men, but *Salmuth* ſaith, 140000. for ſome yeares together. They were placed where now the Church of Saint *Angelo* ſtands. The Turkes at this day retaine that ancient cuſtome of the Romans, and are in nothing more profuſe, then in their Temples and Bathes, which are like vnto great Pallaces, and in euery Citie very frequent. And yet both the Romans and the Turkes vſed thoſe Bathes chiefly for pleaſure, and delicacy, and cleanlineſſe: the Romans going barelegged, and their waies duſty, had need of often waſhing: and the Turkes lying in their cloathes, ſubiect to Lice and wormes, if it were not for their often bathing.

Bellonius obſeruat. lib. 13 cap. 34. Proſper Alpinus de medicina Ægyptiorum.

Moreouer, the dyet of the Turkes, though it be more ſparing then that of the Romans, yet it is little better: namely, vpon hearbs, roots, raw fruit, &c. and their drinke, for the moſt part, water, being prohibited the vſe of wine by their Religion, muſt needs breede many crudities in their bodies, yet by their often bathings, they doe not onely ouercome them, but get a good habit of body, their women being accounted as delicate creatures as any in the world, who duely twiſe a weeke reſort to the Bathes.

Now if thoſe Nations would beſtow ſo much vpon their Bathes of delicacie and pleaſure, which were onely of pure water; wee haue much more reaſon to adorne our minerall Bathes; which (beſides the former vſes) are alſo medicinall and very ſoueraigne for many diſeaſes, conſiſting of wholeſome minerals, and approued for many hundred yeeres, of many who could not otherwiſe be recouered. At the leaſt wiſe if wee doe not beautifie and adorne them, yet we ſhould ſo accommodate them, as they might ſerue for the vtmoſt extent of benefit to ſuch as neede them.

For there is nothing in our profeſſion of Phyſicke more vſefull, nor in the workes of nature more admirable, (man onely excepted, which *Plato* cals the great miracle) then naturall Bathes, and minerall Waters. The nature and cauſes whereof haue beene ſo hard to diſcouer, as our ancient Authors haue written little of them, holding them to be ſacred or holy, either for that they iudged them to haue their vertue immediately from God, or at leaſt from the celeſtiall Bodies; from whence, both their actuall heate was thought to be kindled, by lightnings or ſuch like impreſſions, and other admirable vertues, and ſometimes contrary effects deriued, which appeare in them. Alſo diuers miracles haue beene aſcribed vnto thoſe naturall Bathes, to confirme the opinion of a ſupernaturall power in them, as *Guaynerius* reports of the Bathes of *Aque* in *Italy*: and *Langius* out of *Athenæus*, concerning the Bathes of *Edepſus*, which both loſt their vertue for a time. The one by the Magiſtrates prohibiting poore diſeaſed people to vſe them, the other by impoſing a taxation vpon them: but vpon the reformation of thoſe abuſes, were reſtored to their former vertues againe.

Cap.2.
Epiſt.53.lib.2.

I need not herein auerring the opinion of Diuinitie which was held to be in Bathes, make any mention of the Poole of *Betheſda*, written of by Saint *Iohn*, and *Nonnus* the Poet: nor of the riuer *Iordan*, which cured *Naman* the *Aſſyrian* of his Leproſie, being indeede true miracles, and done by a ſupernaturall power: yet it is likely that thoſe and ſuch like examples bred in the mindes of men a reuerend and diuine opinion of all Bathes: eſpecially where they ſaw ſuch ſtrange effects as they could not well reduce to naturall cauſes.

And this hath beene the cauſe that in old time theſe minerall fountaines haue beene conſecrated vnto certaine deities: as *Hamon* in *Lybia*, vnto *Iupiter*: *Thermopyla*, vnto *Hercules*, by *Pallas*: among the *Troglodits*, another to the *Sun*, &c. And at this day we haue diuers Bathes which carry the names of Sunne, Moone, and Saints: and many Townes and Cities named from the Bathes in them: as *Thermæ* in *Macedonia* & *Sicily*, *Thermidea* in *Rhodes*, *Aquæ* in *Italy*, *Aquiſgran* in *Germany*, *Baden* in *Heluetia*: and our ancient Citie of Bathe in Sommerſetſhire, in honour whereof I haue eſpecially vndertaken this labour, and I perſwade my ſelfe, that among the infinite number of Bathes and minerall waters which are in Europe, there are none of more vniuerſall vſe for curing of diſeaſes, nor any more commodious for entertainement of ſicke perſons, then theſe are.

Beſides this ſacred conceit of Bathes, wherewith in ancient times, the mindes of men were poſſeſt, we may adde this, that the nature of Minerals was not ſo well diſcouered by them, as it hath beene ſince: and therefore wee finde very little written of this argument, either in *Ariſtotle* or *Hippocrates*, or in *Galen*, who wrote moſt copiouſly in all other points of Phyſicke, yet concerning this hath little; and neuer gaue any of theſe waters to drinke inwardly, although hee acknowledgeth that they were in vſe: and for outward vſes, held them all to be potentially hot.

De tuenda ſanit. lib. 4. cap. 4.

After theſe Grecians, the ancient Latines and Arabians ſucceeded: *Pliny*, *Celſus*, *Seneca*, *Lucretius*, *Auicen*, *Rhaſis*, *Seraphio*, *Auerrhoes*, in whom wee finde ſome ſmall mention of naturall Bathes, and ſome vſe of Salt and nitrous, and *Aluminous* waters, but nothing of worth towards the diſcouerie of the naturall cauſes of them. It is likely they did paſſe it ouer ſlightly, either by reaſon of the difficulty in ſearching out the cauſes of them, or that they iudged them meerely metaphyſicall.

But in later times the nature and generation of Minerals (from whence the Bathes proceede, and from whence the whole doctrine of them both for their qualities, and differences, originals and vſe, muſt bee deriued) being better looked into, and obſeruations taken from ſuch as daily labour in the bowels of the earth, for the ſearch of Mines, or ſuch as afterwards prepare them for our neceſſarie vſes; we haue attained to better knowledge in this kinde, then the Ancients could haue, although in all new diſcoueries there will be defects for ſucceeding ages to ſupply, ſo it fals out in this: *Dies Diem docet: Alpham Beta corrigit*. And although *Agricola*, *Fallopius*, *Baccius*, *Matheſius*, *Solinander*, *Libauius*, &c. haue added much vnto that which was formerly known in this point, and reformed many errors and miſtakings in former writers: yet they haue left many things imperfect, doubtfull, obſcure, controuerted, and perhaps falſe, as may appeare in the diſcourſe following. I doe reuerence all their worths, as from whom I haue learned many things, which elſe I could hardly haue attained vnto; and I acknowledge them to haue beene excellent inſtruments for the aduancement of learning: yet I hope it may bee as free for mee without imputation of arrogancie to publiſh my conceits herein, as it hath beene for them, or may be for any other: *Hanc veniam petimuſque damuſque viciſſim*. My end and ſtudie is the common good, and the bettering of this knowledge: and if I ſhall bring any further light to increaſe that, I ſhall be glad: otherwiſe my intent being to ſearch out the truth, and not to contradict others, it will or ought to be a ſufficient protection for me, wherefore I come to diſcourſe of Minerall waters.

Cap. 2.

Definition of Minerall waters. The nature whereof cannot be vnderſtood, except firſt conſideration be had concerning ſimple water. Of which in this Chapter are ſhewed the qualities and vſe.

Minerall waters are ſuch, as beſides their owne ſimple nature, haue receiued and imbibed ſome other qualitie or ſubſtance from Subterraneall Mynes. I ſay, beſides their owne nature, becauſe they retaine ſtill their liquidneſſe and cold, and moyſture, although for a time they may be actually hot from an externall impreſſion of heate, which being gone, they returne to their former cold againe. I ſay imbibed, to diſtinguiſh them from confuſed waters: as earth may bee confuſed with water, but not imbibed, and will ſinke to the bottome againe: whereas ſuch things as are imbibed, are ſo mixed with the water, as it retaines them, and is vnited with it: being either Spirits, or diſſoluble Iuyces, or tinctures, I ſay from Subterraneall mynes, to diſtinguiſh them from animal or vegetable ſubſtances, as infuſions or decoctions of hearbs, fleſh, &c. *Libauius de iudicio aquarum miner. cap. 1.*

Seeing then that the Baſis of theſe Bathes or minerall fountaines, is water, we muſt firſt conſider the nature of ſimple water, and from thence wee ſhall better iudge of Minerall Waters and their differences.

By ſimple water I doe not meane the Element of water, for that is no where to be found among mixt bodies, but I mean ſuch water as is free from any heterogeneall admixture, which may alter either the touch or taſte, or colour, or ſmell, or weight, or conſiſtence, or any other qualitie, which may be diſcerned either by the ſenſes, or by the effects. This water therefore muſt haue his pro- *Baccius lib. 1. cap. 6. Solinander lib. 2. cap 1.*

per colour and taſte, without ſauour, or ſmell, thin, light, cold, and moyſt; if any of theſe properties be wanting, or any redownd, it is mixed and infected.

Solinander lib.1. cap.3.

Quæſt. nat. 2.
Libau. pyrotech. cap.20.

Meteor 4.

De vſu partium lib.8. cap 3.

Cold and moyſture doe abound in water. For cold appeares by this, that being heated by any externall cauſe, it ſoone returnes to his cold nature againe, when the cauſe of the heate is remoued. And whereas Ayre is held by the Stoicks to be moſt cold, and confirmed by *Seneca* and *Libanius*, yet the reaſon they giue for it, doth ſeeme to proue water to bee more cold, becauſe they make the matter of ayre to bee water, and to haue his coldneſſe from thence. But *Ariſtotle* holds the ayre to be hot from the efficient cauſe which rarefied it, being of more validitie to make it hot, then water (the materiall cauſe) to make it cold. *Galen* is of neither ſide, for he doth not iudge it to bee hot, neither doth hee euer pronounce it to be cold: but by reaſon of his tenuity, apt to be altered either by heat or cold.

Damæus phiſ. Chriſt part 2. cap 9.
Ariſtot 1, Meteor. cap. 4.

I will not here vndertake to determine whether all be bred of water, or whether it bee not a diſtinct ſubſtance of it ſelfe, and onely receiueth watry vapours into it, being agreeable in cold, moyſture, tenuity, &c. with it, and ſo lets them ſeparate in raine: and ſo exonerate it ſelfe of theſe vapours, as alſo of dry exhalations by windes, thunder, &c. or whether ayre bee onely the *effluuium* of the inferiour globe, being within the orbe of his vertue: as all Dominion hath not onely a place of reſidence and Manſion, but alſo a verge and territory where it exerciſeth his authority and gouernement; ſo the inferiour globe of the earth, and water hath his dominion beyond his owne globe, as likewiſe may bee thought of all other globes of the Planets, &c. But theſe points are impertinent to my purpoſe. It is enough for me to ſhew what I iudge of the temperature of the ayre, concerning heate or cold. And to mee it ſeemes moſt probable, that the ayre of it ſelfe ſhould be cold, as may appeare by this, that it is onely heated by externall cauſes, which being remoued, the ayre returnes to his former coldneſſe againe. So we ſee that within the Tropicks in *Zona torrida*, as long as the Sunne is within their Horizon, and beats the ayre with his perpendicular beames, it is exceeding hot, eſpecially in the vallies, where the reflection is moſt: in ſo much as *Ariſtotle* held thoſe parts of the world to be inhabitable, in regard of the extremity of heat. But after the Sunne is ſet, the ayre returnes to his naturall coldneſſe, vntill the Sunne ariſe and heat it againe. *Ioſephus à Coſta* vrgeth this argument againſt *Ariſtotle*, about the habitableneſſe of the torrid Zone, that the dayes and nights being there equall, the preſence of the Sunne in the day time may well heate the ayre, but his abſence for twelue houres more in the night, reduceth the ayre to a better temper: and vpon this and diuers other arguments and experience, which cannot be denyed, concludes, that if there be any Paradice vpon earth, it is vnder or neare the equinoctiall. The like reaſon may be drawne from the coldneſſe of mountaines, which being neere to the middle region of the ayre, and wanting that reflection of the beames of the Sunne, which is in the valleyes, are continually cold, and often couered with ſnow, which would not be if the ayre were hot. As for the conceit that the middle region is made cold by an Antiperiſtaſis, the element of fire being aboue it, and the reflection of the beames of the Sunne beneath it, it is an idle conceit. For theſe heats on both ſides would rather heat then coole the middle region by by their working vpon it. Alſo take away the element of fire from vnder the Moone, which is an opinion now exploded by the beſt

Phi-

Philoſophers, and then what becomes of your Antiperiſtaſis? But I ſhall ſpeake more of this Antiperiſtaſis, *cap.* 13. And as for the reflection beneath, it is a weake thing, and will hardly extend to the top of a ſteeple: wherfore this coldneſſe of the middle region is not from any Antiperiſtaſis, but from the nature of the ayre, which there is not altered either by any influence from aboue, or by any vapours or reflection from beneath.

Danæus Philoſ. Chriſt. p.2. c 8. Cardan. de ſubtil. lib.2 Valeſius contr. lib.1. cap.5 Conradus Aſlachus de triplici cœlo lib.1. cap.4: Laurent. Valla, &c.

Neither would it be ſo cold neere the Poles, if the ayre of it ſelfe were hot. But the long abſence of the Sunne in thoſe parts, and the oblique beames when it is preſent, doe permit the ayre to enioy his naturall coldneſſe. And as the ayre is of it ſelfe, and in his owne nature cold, ſo it is probable that it is more cold then water, ſeeing it hath a greater power of condenſation, then water, as we ſee it congeales water into yce, ſnow, haile, &c. which the water cannot doe of it ſelfe. For in the bowels of the earth, where the ayre cannot freely paſſe, water is neuer found to be congealed, vnleſſe it be compaſſed by ſome other ſubſtance equiualent to ayre in coldneſſe, as Quickſiluer, Niter, &c. where cold is drawne into a greater compendinm, then in water, by reaſon of the denſity of their ſubſtances: and in yce and ſnow, the cold may be greater, by reaſon of the admixture of ayre. It is likewiſe probable that earth is more cold then water, if we conſider it as it is in it ſelfe, and not mixed with other heterogeneityes. For as motion cauſeth heat, and leuity, and rarityе, ſo want of motion, which is in earth, cauſeth coldneſſe, denſity, and ponderoſity. But it is enough for our purpoſe to proue both ayre and water to be cold. As for moyſture, *Ariſtotle* holds the ayre to be moſt moyſt, and water moſt cold. *Galen* holds Water to be moſt moyſt. *Ariſtotles* reaſon for the predominance of moyſture in Ayre is, becauſe

Ariſt. 1. Meteor. cap. 3.

De ortu & inter. lib.2. & meteor. 4. cap 1. & 4. Gal. de ſimpl. med. fac. lib. 1. cap. 8. Item de Elementis 1 it is moſt hardly contained within his bounds: but the termination of things, proceeds from their oppoſite qualities, as moyſture is terminated by dryneſſe, and dryneſſe by moyſture: and dryneſſe doth as eaſily terminate moyſture, as moyſture doth terminate dryneſſe. And this difficulty of termination in ayre, may more properly bee aſcribed to his thinneſſe and tenuity of parts, then to his moyſture. For dry exhalations will extend themſelues as well as moyſt vapours; and as it is denſity that compacts, ſo it is rarity that extends. Fire it ſelfe is more hardly bounded then ayre, and yet, not moyſt. Thoſe that would reconcile theſe differences, doe alledge that *Galen* ſpeakes as a Phyſician, and meant that water was *humidiſsimum medicamentum*: *Ariſtotle* as a Philoſopher meant it to be *humidiſsimum elementum*. But this reconciliation giues little ſatisfaction. For how could water be *humidiſsimum medicamentum*, if it were not *humidiſsimum elementum*? For the ſimple qualities are more intenſe in the elements, then in mixt bodies, *cæteris paribus*. We ſpeake of the proper operation of water according to his naturall qualitie, and not as it may worke by accident. Thinneſſe and leuitie are two other qualities of ſimple water, which *Hippocrates* commends, and addes this experiment in another place, that it is quickly hot & quickly cold. *Galen* addes another experiment in the quick boyling of Peaſen and Beanes.

Valeſius cont. lib.1.cap.2.

De aere, aquis & locis.

De morbis popular. lib.2. ſect.2.

And whereas *Galen* produceth the boyling of Beanes as a familiar example to ſhew the tenuity of water, wee may gather that the vſe of Beanes was common in thoſe dayes, although the Pythagorian ſect did then much flouriſh, which were thought to forbid the vſe of them. But I finde that here hath beene a great miſtake. For *Ariſtoxenus* who wrote of the life and doctrine of *Pythagoras*, affirmes that he did delight much in that kinde of food: and our Phyſitians commend them for looſing the belly, and drying of rheumes. But it ſeemes the cauſe of this miſtake was a verſe of *Empedocles*, Δειλοὶ πάνδειλοι κυάμων ἄπο χεῖρας ἔχεσθαι. *cyamis ſubducite dextras*. As if he had forbidden the vſe of Beanes, a poore occaſion to pronounce them miſerable which vſed them. But he meant it of continency and abſtinence from venery, as *Aulus Gellius* doth interpret it: where κύαμοι are vnderſtood to be *teſticuli*. *Cicero* mentioneth the ſame of the Pythagorians, but in another ſence, becauſe Beanes were thought by their flatulency, to diſturbe our dreames, and ſo to hinder the diuination which might be gathered from them, as alſo *Middendorpius* judgeth. But to returne to water. And it is requiſite that water ſhould haue theſe qualities, in regard of the manifold and neceſſarie vſes of it, both for Man and Beaſt, and Plants: inſomuch, as there is no liuing for any creature, where there is no water. It was our firſt drinke to quench our thirſt, and to diſtribute our nouriſhment as a *vehiculum*, which it doth by his tenuitie; and after the inuention of VVine, it was mixed therewith, as *Virgil* ſaith of *Bacchus*, *poculaque inuentis Acheloia miſcuit vuis*; where, by *Acheloia*, hee meanes not onely the water of the Riuer Achelous in Etolia, but all other waters, as *Macrobius* proues out of *Ariſtophanes* and *Ephorus*: and *Scaliger* ſaith that the Greekes called all waters by that name, from the word λύειν. And ſince the planting of Vineyards, ſeeing all Countries could not beare Grapes, *Bacchus* alſo taught the world to make *vinum è frugibus* with water, as *Diodorus Siculus* reports, from whence the Egyptians had their *Zithum* and *Curmi*, the Spaniards their *Cerea*, the Turkes their *Cowſet*, and wee our *Ale* and *Beere*; all which are extracted out of Corne, by the pureneſſe and

tenuitie

Brutrinus de re cibaria.
Platerus in praxi.

Noct. Attic. lib.4.cap.11.de Diuinat.1.
In Ariſtæum quæſtione 19.

Brutrinus de re cibaria lib.16. cap 7.

Saturnal. lib.5. cap.18.

Rerum antiquar.lib.4.c.12

tenuitie of water. By meanes whereof wee haue our Brothes, Syrupes, Apozemes, &c. extracted with it, as a fit menſtruum to receiue the faculties of all medicaments and nouriſhments, eſpecially the ſecond qualities, and therefore it was anciently called *Panſpermia*: beſides the manifold vſes in waſhing, dying, &c. where that water is accounted beſt, which lathers moſt, being mixt with ſoape, of which I will not diſcourſe farther. Leuitie is another note of pure water, alledged by many, and ſerues well to diſtinguiſh it from many mixed waters, whether we reſpect the weight of it, or the moleſtation which it breedes in the bowels. This difference of weight is hardly diſcerned by ballance, both becauſe ſimple waters doe very little differ in this point, and alſo many mix waters, if they be onely infected with Spirits, and not corporall ſubſtances, retaine the ſame proportion of heauineſſe with ſimple water: and alſo becauſe it is hard to haue great ballances ſo exact, as a ſmall difference may bee diſcerned by them, yet *Agricola* reports that a cotyle of the water of Pyrene and Euleus, did weigh a dram leſſe then the water of Euphrates, or Tigris, and therefore the Kings of Perſia vſed to drinke of it, and held it in great account, as alſo the water of the Riuer Coaſpis. Thus much for the qualities which ſimple water ſhould haue; for ſuch as it ſhould not haue, I ſhall not need to ſpend time in diſcourſe, being either ſuch as the ſenſes will diſcouer, if it be in taſte, colour, ſmell, or touch; or the effects, if it be purgatiue, vomitory, venomous, &c.

Baccius lib.1.c.7

De nat. eor. quæ effl. è terra lib.1. cap.15.

Langius Epiſt. lib.1. Epiſt.31.

CAP. 3.

Of the three originals of ſimple waters.

Baccius lib.1. cap.3.4. Agric. de ortu & cauſis ſubterr. lib. 1. cap. 1,2,3,4,5,6,7,8,9. Solinander lib.2 cap.2.& lib.1. cap.3.

NOw it followeth that we ſhew from whence theſe waters haue their originall, which is no other then of the mixt waters, ſauing that the mixt waters doe participate with ſome minerals which are imbibed in them:

They haue three ſeuerall Originals: the one from moyſt vapours congealed by cold in the ayre:, the ſecond from the earth, the third by percolation from the Sea.

For the firſt, it is certaine that our Springs and Riuers doe receiue great ſupply of waters from the Ayre, where vapours being congealed by cold, doe fall downe vpon the earth in raine, or ſnow, or haile, whereby the ground is not onely made fertile, but our Springs are reuiued, and our Riuers increaſed. As we ſee the Rein and Danubius to ſwell more in ſummer then in winter, becauſe then the ſnow which continually lyeth vpon the Alpes, doth melt by the heate of the ſunne, and fils thoſe Riuers, which haue their Originals from thence vp to the brinkes. Alſo we ſee daily after much rain, our ſmall Lakes and Riuers to be very high. Alſo vpon much dryth our Springs faile vs in many places, which vpon ſtore of raine doe ſupply vs againe with water. And this is the cauſe that in moſt parts of Africa, neere the Equinoctiall, where it raines little, they haue little water; and many times in two or three dayes iourney, can hardly finde to quench their thirſts and their Camels. *Leo Africanus* ſpeakes of an Army wherein were many Camels, which in their marching, comming to a Riuer, (perhaps it was but a Brooke) did drinke it dry. So that we muſt acknowledge that the earth receiues much water this way. But how this ſhould ſerue the bowels of the earth with ſufficiencie for the generations there, and for perpetuall ſprings, is very doubtfull; whereas *Seneca* ſaith that theſe waters doe not pierce aboue ten foot into the earth: neither if there were paſſages for it into the bowels of the earth, can the hundred part of it be imployed this way, but is readily conueyed by Riuers into the Sea. Wherefore although much water be yeelded to the ſuperficies of the earth by raine, and ſnow, and haile from the ayre, yet not ſufficient to maintaine perpetuall Springs; ſeeing many times, and in many countries theſe aëriall ſupplies are wanting, or very ſpare, and yet the Springs the ſame. Wherefore *Ariſtotle* his opinion, which attributes all to aëriall water and vapours, from thence, is iuſtly reiected by *Agricola*, and by our country-man Maſter *Lydiat*. So that wee muſt finde out ſome other Originals, or elſe wee ſhall want water for the manifold vſes the earth hath of it. From the earth they make another originall of perpetuall Springs & Riuers, ſeeing the firſt ſeemes to be ordained by nature onely for the irrigation of the ſuperficies of the earth, which elſe would be in moſt places deſtitute of water, where Springs are not, and ſo would bee barren, plants and trees wanting due moyſture for their nouriſhment. Wherefore for the perpetuitie of fountaines, and for Subterraneall generations, which cannot proceede without water, they haue imagined a generation of water within the earth, ſome holding that the earth it ſelfe is conuerted into water, as elements are held to bee mutable and conuertable, the one into the other. As *Ouid* ſaith of the conuerſion of Elements: *Reſolutaque tellus in liquidas rareſcit aquas, &c.* But we muſt grant *Ouid* his poeticall liberty, and not tye his words to

Quæſt. natur. lib. 3. cap 7.

2 Meteorol. & 1. 3.

De ortu & cauſis ſubt. lib. 1. c. 6.

De orig. font. cap. 1.

Metam. 15.

ſuch a ſtrict ſence although *Scaliger* in his Criticks would not pardon a Philoſophicall errour in the firſt verſe of his Metamorphiſis, for ſaying that formes are changed into new bodies. But vnleſſe there bee ſome reciprocation betweene water and ayre, the other elements are not conuertible the one into the other. For neither fire will be conuerted into any other element being ſuperiour vnto the reſt, and not to be maſtered by cold, which onely muſt be the agent of the conuerſion of it by condenſation: neither will earth be conuerted into water, or any other element, as *Plato* thinkes in *Timæo*, and *Ariſtotle* 3. *de cœlo cap.* 7. for either heate or cold muſt conuert it. Heate cannot doe it, although it rarifie and attenuate, both for that it conſumes moyſture, and alſo becauſe water is cold, which it ſhould not be, if it were made by heat; for euery naturall Agent workes to that end that it may make the Patient like it ſelfe: and heate may conuert earth into fume and dry exhalations, but not into water, for all water which is not eternall, is from cold; likewiſe cold cannot conuert earth into water, becauſe cold doth congeale, condenſe, and congregate, and indurate, and not diſſolue and attenuate, &c. as wee ſee in Amber and Gummes. Neither will water be conuerted into earth. For by heat it turnes to vapour and ayre, by cold into ice and ſtone; wherefore the Elements are not changed the one into the other, vnleſſe it bee water and ayre, which haue more affinity and more neighbourhood then the reſt. And yet it is doubtfull, as I haue ſaid in the former chapter: but this generation of water from the earth is impoſſible. Others will haue great receptacles of ayre within the earth, which flying vp and downe, is congealed by the coldneſſe of Rockes into water, to ſupply all wants. Others imagine huge Lakes and Ciſternes,

Ariſtotl. 4 meteor. cap. 10. & vltimo.

Valeſius de ſacra philoſoph. paſſim.

primarilie framed in the earth, and ſupplied with water, either from vapour or ayre, or from the ſea; which water either by agitation, by windes, or by impulſion from the ſea, or by compreſſion of Rocks, is eleuated to the Superficies of the earth: or elſe vapours from thence, made by attenuation, either from the Sun and Starres, or from Subterraneall fire kindled vpon Sulpher and Bitumen; which vapours aſcending to the tops of mountaines, are there congealed into water by the coldneſſe of the Rockes; where there muſt be other Ciſternes or Caſtles in the ayre to feede the inferiour Springs. Others will make the earth to be an animal, and to ſucke water by veynes, to ſerue his turne for generations and nutritions. But why ſhould it ſucke more then it hath neede of? and how ſhall it caſt it forth beyond the place of vſe, to the ſuperficies of the earth? Vnleſſe they will ſay that the Mynes which ſucke it, doe puke it vp as Infants doe when their ſtomackes are full, which is abſurd to ſay. Theſe and ſuch like deuices are produced for the maintaining of their Originall; which as they are all inſufficient to afford ſuch a proportion of water as is requiſite, ſo moſt of them are ſo improbable, and full of deſperate difficulties, as I am vnwilling to ſpend time in the rehearſing of them, or their Authors, much more vnwilling in confuting of them, to trouble my ſelfe, and offend my Reader, onely the point of Subterraneall fire which hath taken deepeſt impreſſion in moſt mens mindes, I ſhall ſpeake of hereafter, when I come to ſhew the cauſes of the actuall heate of Springs. The third Originall is from the Sea, a ſufficient ſtorehouſe for all vſes, and whereunto the other two may be referred. For that which fals from the ayre, and that which is bred in the earth, doe proceed principally from the Sea. *Agricola* for feare of wanting water for his Springs, is contented

De ortu & cauſis ſubter. lib. 1. *cap* 5. & 9.

to admit of all theſe Originals, although he relyeth leaſt vpon the Sea, becauſe he knowes not how to bring it vp to the heads of his fountaines, but is contented it ſhould ſerue for lower places neare the Sea coaſt. As I remember I haue ſeene in Zeland at Weſtcapell, freſh Springs colated from the Sea, through bankes of ſand. But I make no doubt but that the Sea water may ſerue all other Springs and Riuers whatſoeuer, although both farre remote from the Sea, and high in ſituation. Neither ſhall we neede to flye for helpe to thoſe monſtrous conceits of Agitation, Compulſion, Compreſſion, Suction, Attraction by the Sunne, &c. But holding the ſacred Canon of the Scriptures, that all Riuers are from the Sea, &c. I perſwade my ſelfe, that there is a naturall reaſon for the eleuating of theſe waters vnto the heads of Fountaines and Riuers, although it hath not yet beene diſcouered. For thoſe opinions formerly mentioned will not hold water.

Eccleſiaſtes 1.

My conceit therefore is this, that as we ſee in *Siphunculis*, that water being put in at one end, will riſe vp in the other pipe, as high as the leuell of the water (whether by his weight, or by the correſpondence with his leuell, I will not diſpute) ſo it may bee in the bowels of the earth; conſidering that the paſſages there are more firme to maintaine the continuitie of the water with the Sea, then any leaden pipes can be, being compaſſed on euery ſide with many Rockes: as we ſee in *Venis, fibris & commiſſuris ſaxorum*. Now although perhaps this water enters into the earth very deepe, yet the leuell of it muſt anſwer to the ſuperficies of the Sea, which is likely to be as high as the ſuperficies of the Land, ſeeing the natural place of waters is aboue the earth. And although neere the Coaſts it bee depreſſed and lower then the Shoare, yet there is reaſon for that, becauſe it is termina-

Ariſt. meteorol. cap. vltimo lib. 1.

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red by the dry and ſolid body of the earth: as we ſee in a Cup or Bowle of water filled to the top, we may put in a great bulke of ſiluer in pieces, and yet it will not run ouer, but be heightened aboue the brims of the bowle. The like we ſee in a drop of water put vpon a Table, where the edges or extremities of the water being terminated by the dry ſubſtance of the Table, are depreſſed, and lower then the middle, like a halfe globe: but take away the termination by moyſtening the table, and the drop ſincks. If this be euident in ſo ſmall a propor. tion, we may imagine it to be much more in the vaſt Ocean: and our Springs being commonly at the foot of hils, may well be inferiour to the Globe of the Sea, if any be higher, they may perhaps be fed from raine and ſnow falling vpon the mountaines. But if *Ioſephus a Coſta*, his aſſertion be true, that the Sea towards the Equinoctiall, is higher then towards the Poles, then the leuell of the Sea may bee much higher then the top of our higheſt hils, but this is a doubtfull aſſertion: yet I dare beleeue that if it were poſſible to immure a Spring without admiſſion of ayre, which might breake the continuitie with the Sea, our Springs might be raiſed much higher. At Saint *Winifrids* Well in Flintſhire, though there be no high land neere it, yet the Springs riſe with ſuch a violence, and ſo plentifully, that within a ſtones caſt, it driues a Mill. It is likely that this Spring might be raiſed much higher, And whereas we ſee that Riuers doe run downewards to the Sea *per decliue*, it doth not proue the Sea to be lower then the Land, but onely neere the ſhore where it is terminated, and in lieu of this it hath ſcope aſſigned it to fill vp the Globe, and ſo to be as high as the Land, if not higher. For if a meaſure ſhould bee taken of the Globe of the earth, it muſt be taken from the tops of the Mountaines, and from the higheſt of the

Sea, and not from the Vallies, nor from the Sea-coaſts. This conceit of mine I was fearefull to publiſh, and therefore had written vnto Maſter *Brigges*, mine ancient friend, for his aduice in it, being a point wherein he was well ſtudied: but before my Letter came to Oxford, he was dead. But now I haue aduentured to publiſh it, to ſtir vp others to ſearch out the cauſes hereof, better then hath yet beene diſcouered. *Exors ipſe ſecandi, fungar vice cotis.*

Cap. 4.

Diuiſion of Minerall Waters. Minerals deſcribed. Their kindes recited. Of earth, ſimple and mixed. Whether it giue any medicinable qualitie to water: And ſo of the reſt in the following Chapters.

THus much of ſimple waters, and their originals, which may ſerue as *Polycletus* his rule to iudge mixed and infected waters by: as *Galen* in many places ſpeakes of an exact and ſound conſtitution of body, as a rule to diſcerne diſtempered and diſproportionated bodies. And thus much in explication of the *Genus*, in the definition of Minerall waters.

Now I come to Minerall Waters, and to the other part of the definition which wee call difference, &c. from Subterraneall Mynes by Imbibition.

Theſe Minerall waters are either ſimple or compound; ſimple, which partake but with ſome one Subterraneall Minerall; compound, which partake with moe then one. And theſe waters partake with Minerals, either as they are confuſed with them, or as they are perfectly mixed. Alſo theſe minerall waters, whether ſimple or compound, are actually either hot or cold; the reaſon whereof muſt proceede from ſome Subterraneall cauſe, as ſhall be ſhewed hereafter.

Wherefore wee muſt firſt know the nature of theſe Subterraneall Minerals, and their generation, from whence Minerall waters receiue their difference, from common ſimple water, before wee can iudge of the nature and qualitie of them, either Actuall or Potentiall.

By Minerals, we vnderſtand all Inanimat perfect bodies, bred in Mynes within the bowels of the earth. I dare not vndertake to muſter theſe in due order by Dicotomyes, ſeeing neither *Agricola* nor *Fallopius*, nor *Libanius*, nor any other that I know, haue exactly done it, nor ſatisfied either others or themſelues in it: and ſeeing there are diuers Minerals lately diſcouered, and perhaps more may bee hereafter, which haue not beene knowne in former times, and therefore not mentioned; as *Calaem* in the Eaſt Indies, *Ruſma* and *terra ghetta* in Turkey, &c. Wherefore I will make bold to reckon them vp as they come to hand in ſeauen rankes.

The firſt ſhall be earth.

Earth whether it be bred *ab exhalatione ſicca refrigerata*, or *ex miſtis per putredinem in fimum cōuerſis*, or *ex lapidibus ſole aut calore coctis & deinde aqua ſolutis, &c.* it is all inconcrete. As a little water gleweth it together in *Lutum*, ſo a great deale diſſolues it. But this is no proper diſſolution, but onely a diſioyning of parts by Imbibing the moyſture which conioyned them, into a greater proportion of water; for waters doe naturally runne together, like drops of quickſiluer, or melted mettall. Wherefore ſeeing the moyſture which is in the earth, is not naturall, but aduentitious, not vnited eſſentially, but onely mixed acidentally, it may well bee called an *inconcrete* ſubſtance, whoſe moyſture is eaſily drawne from it, being readie to vnite it ſelfe with other

Agric. de nat. foſſil. lib.1. cap.4.

moyſture, and leaue his old body as it found it, that is, duſt; yet ſo as that water retaines with it ſome taſte or qualitie which it receiued from the earth. This duſt is neither a ſimple body, as Elements are, nor permanent in one and the ſame kinde: but as it is thought to participate with *animales vegetables*, and minerals, ſo to be tranſmuted into any of them, being both Mother and Nurſe to all terreſtriall bodies.

Simple earth, if it be not mixed with other ſubſtances, is dry and cold, and Aſtringent. But if it bee mixed, as commonly it is, it altereth his qualitie according to the mixture. Mine intent is to write of it as it is ſimple, and ſo of the reſt.

Simple earth yeelds but a muddie water of it ſelfe, and of no vſe in Phyſicke, but if it be mixed with other Minerals, it makes the water to participate with the quality of thoſe Minerals alſo. As if it be mixed with niter, as in Fullers earth and Marle, it makes the water abſtergent like Soape. If with Allum or Copperesſe, aſtringent and more deſiccatiue, as in all ſorts of Boles. If with Bitumen, fattie and Vnctious, as in Turfe and Peate, &c. We haue diuers examples of all ſorts. The Bath of Mount Othon in Italy is full of clay, which is a kinde of Bole. The Bath Caldaria, full of Ocre. The Bath of Saint *Peter* full of a yellow earth, tincted belike with ſome other Minerals. Wherefore theſe are to be iudged of according to the ſeuerall Minerals which they containe. But ſeeing earth it ſelfe makes little impreſſion into water, neither doe we make any Phyſicall vſe of waters, which containe nothing but earth, I need not ſpend any time about them.

Baccius lib.5. cap.11

CAP. 5.

Of Stone:

De metallis cap. 6.

THe ſecond ſhall be Stone. Stone is another Minerall ſubſtance,concrete and more heauie then earth, and our Minerall men confound themſelues much in the definition of it. Wherefore *Fallopius* implores the help of *Marcus Antonius Ianna* about it,as one of the moſt difficult points in Philoſophie:but in the end, defines it by his want of diſſolution,either by heate or moyſture. And whereas it is manifeſt that ſome Stones will melt, he imputes it to the admixture of ſome mettall, among which he reckoneth glaſſe. Others define it by his hardneſſe, wherein commonly it goeth beyond other Minerals. But you ſhall haue ſome ſtones ſofter then ſome of thoſe,and therefore the definition is not good. Others by this,that being broken or calcind, they will not bee conſolidated againe into their former conſiſtence or ſhape. But for breaking,the reaſon of that, is want of fuſion; for without fuſion or ignition, which is a kinde or degree of fuſion, Mettals alſo being broken, will not be conſolidated into the ſame Maſſe againe. And there is no more difference in nature or eſſence, betweene a whole ſtone and a broken, then there is betweene a maſſe of Mettall,and the powder or filings of the ſame. As for calcination, other minerals may be ſo farre calcind, and brought to a Crocus by fire,as they will be irreducible, therefore this is not proper to ſtone. Wherefore I am of *Fallopius* his opinion in this point, and the rather becauſe otherwiſe there would ſeeme to be a ſpecies in nature wanting, if there were not Minerall Species wanting, diſſolution by heate or moyſture, as well as there are, hauing ſuch diſſolution. And this *vacuum* which

nature

natures abhorres, is not onely to be vnderſtood of a locall vacuitie, but alſo of a want of ſuch ſpecies as are in natures power to produce, for the ornament of the world. For if it be a naturall paſſion to be diſſolued, it is likewiſe a naturall paſſion not to bee diſſolued: and if ſome things will bee diſſolued both by heate and moyſture, as Salts, why ſhould there not be other ſubſtances which will be diſſolued by neither of them. And this muſt be ſtone, for nature affords none other. Moreouer according to *Ariſtotle: Quæ concreuerunt a frigido & a calido, a nullo iſtorum diſſoluuntur.* Of this kinde are Stones which could neuer attaine to ſuch puritie as many of them haue, if they were not congealed by heate as well as by cold. Alſo vnder what ſpecies ſhall we comprehend, Diamonds, Talcum, blacke Lead, which ſome thinke to be *pnigitis, Magnetis, Glymmer, Katzenſilber, pyrimachus, amiantus, alumen plumoſum, ſaxum arenarium mortuum, &c.* if not among Stones? yet theſe are confeſſed to be inuincible by fire or water. Alſo all pretious Stones, the more noble and pretious they are, the more they reſiſt diſſolution either by fire or water: for this qualitie ſheweth the peefection of their mixture. True it is that ſome ſtones wil bee diſſolued by fire or water, and therefore *Pliny* and *Agricola* diuide Stones into fuſible and infuſible: but this is in regard of other ſubſtances bred in the ſtone; which if it be Metall, the fuſion will be Metallin: If Niter or meane Minerals, it will be vitrificatorie. As *Pliny* reports of the inuention of Glaſſe by certaine Merchants, who melting Niter vpon the ſand in Syria, where with clods of Niter they had made a furnace for their neceſſary vſe; found that cleere metall which we call glaſſe, *Ecce liquato nitro cum arenis viſi ſunt riui fluxiſſe nobilis liquoris.*

If Sulphur, as in *pyrite*, it will likewiſe melt and ſtrike fire. And whereas the ſtriking of fire out of a flint or pyrites, or any other thing that will ſtrike fire, is held by all men to proceede from the kindling of ayre, by the colliſion of two hard ſubſtances together, they are miſtaken. For then Diamonds, Chryſtall Glaſſe, &c. ſhould ſtrike fire as well as flints; but it is the Sulphur contained in them: And *G. Fabricius* in his obſeruations, although he obſerues not the reaſon of this fire, yet he confeſſeth that out of any Pyrites *è quo excutitur ignis, etiam excoquitur ſulphur*. *Pliny* giues the reaſon of the name, *quia ineſt ignis illi*. The like we obſerue in Indian Canes, and ſome Woods that are vnctuous, and full of oyle, which will yeeld fire by frication, or colliſion, not by kindling the ayre thereby, but the inflamable oyle in them. For ayre being cold and moyſt, as hath beene proued before, hath no agreement with fire, no more then oyle hath with water. And therefore flame is not the kindling of ayre (*flamma non eſt aer accenſus*) but of fuliginous vapours, which haue ſome vnctuouſneſſe in them, and ariſe from the matter of fewell, and haue ſome imflamable parts remaining in them: which neere vnto the matter of fewell, doe cauſe a manifeſt flame: but farther off, no flame doth appeare: yet ſo as if you hold flaxe neere vnto the flame, though it touch it not, yet it will kindle, by reaſon the fire extends further then it is viſible, being a pellucide and tranſparent body, and thinner then the ayre it ſelfe. And this is held to be the cauſe why it is not viſible vnder the Moone. And whereas without ayre fire goes out, and is extinguiſhed, the reaſon is, becauſe the fuliginous vapours wanting euaporation, doe recoyle vpon the fire and choake it. This is euident in cupping glaſſes, and in making of Char-Coale: where if the ayre be altogether excluded, the fire goes out; if but in part, then

Verulanius de vita & morte, pag.418. & 453 then although the flaming be hindred, yet the fire doth penetrate the fewell, and ſo conuerts it to coales: which by reaſon of the fuliginous vapours, are commonly blacke. *Bellonius* ſaith that Char-Coales made of the wood of the Oxycedar tree, are white; which muſt be aſcribed as I thinke, to the ſmall quantity of fuliginous vapours which that wood doth yeeld: or elſe that thoſe vapours are rather ſulphurous, then of any other combuſtible ſubſtance. As we ſee that Tinby Coales will not blacke linnen, being hanged in the ſmoake of them, but rather whiten it, by reaſon of the drying and penetrating quality of ſulphur, which will make red roſes white.

De neglectâ ſtirpium culturâ problem. 13.

But what ſhall wee iudge of thoſe Lamps, which haue beene found burning in old Sepulchres? ſome of them (if wee may beleeue hiſtories) hauing continued 1500. yeers together, as that which was found in *Paulus* the third his time, of *Tullia, Ciceroes* daughter: and another of *Maximus Olibius*, neere vnto *Padua*, as *Bernardinus Scardeo* reports. It ſeemes here was no ayre to maintaine the Lampes, being cloſely ſhut vp in glaſſes, and therefore they burnt without ayre, and were not extinguiſhed, by reaſon they bred no fuliginous vapours to choake them.

Now whether theſe oyles which fed the Lampes were made by Art out of gold, as ſome think, & I hardly beleeue, or rather out of ſome pure kinde of Naphtha, which is moſt probable, I leaue to others to iudge: onely I iudge it to be the purity of that oyle, which yeelded no fuliginous vapours to choake the fire. If ayre had maintained the flame, it had not continued two minutes, for it would haue beene ſpent and waſted by the fire. Wherefore *ignis non eſt aer accenſus*. If other concrete iuyce be mixed with ſtone, as Salt, Allum, *Eraſtus diſput. part, 2. pag. 105.*

Vitrioll, &c. it makes them to relent in water or moyſt ayre; and theſe ſtones are neuer good to build withall. But let vs take ſtone as it is in it ſelfe, without the admixture of other Minerals, and we ſhall finde it to be indiſſoluble and inuincible, either by fire or water.

Metallurgians, Refyners, and Aſſay maſters, may make vſe of this for their Shirbs, Tiegles, Muffels, Copels, Teſts, Hearths, Crucibles, furnaces, &c. where they deſire a defenſible ſubſtance againſt fire. But it requires a preparation to cleere it from all combuſtible and diſſoluble admixture: as they may eaſily doe, after they haue powdred their ſtone, to calcyne it and waſh it well. This worke being often repeated, will make it fit for their purpoſe: and they may vſe it either alone in the ſame manner as they doe bone-aſhes, or they may mixe it with their lome, bricke duſt, geſtube, &c. Alſo they may make brickes of it for their furnaces, which will hardly receiue any iniury from fire. Talcum alſo is a ſtone inuincible of it ſelfe by fire: and Bricks made of clay that is full of it, as the Guendern clay in Cornwall, will hardly melt with any heat. Stones are naturally dry and cold, and aſtringent like a concrete earth.

Simple Stones which haue no other Minerals mixed with them, and are come to their perfection, being indiſſoluble, either by fire or water: can yeeld no qualitie or vertue to Bathes, and therefore hee that ſeekes to draw any vertue from ſtone into water, doth *lapidem lauare*, that is, labour in vaine. But by reaſon of admixtures, they may, or whileſt they are in *ſucco lapideſcente*, before they are concreted. For if it be certaine that metals may yeeld vertue to Bathes, being alike indiſſoluble by water, there is no reaſon but Stones alſo may. *Fallopius* is againſt it in both, but contradicted by *Iulius Cæſar*, *Claudius*, and diuers others; yet hee confeſſeth that

In ingreſſu ad infirmos p. 373. Venuſtus in conſilio pro Petro Picardo. Baccius elym.

that *Balneum montis Grotti*, hath *Gypſum*: and *Geſner* affirmes the ſame of the Baths of Eugeſta. Alſo he findes *ramenta marmoris in Balneo Corſenæ & Agnano*, but he iudgeth that they receiue no qualitie but from the iuyce, and I doubt not but he is in the right. And for *ſuccus lapideſcens*, we haue many examples in *Agro Piſano & Lucenſi* in Italy, in Auernia in France, where this iuyce is ſo plentifully brought by a cleare Spring, that after it is congealed, the people digge the ſtones, and haue made a great bridge of them. Alſo neere Vienna in Sauoy, in a village called Giret, is a cleare fountaine which turns to ſtones as hard as flints: *Pliny* makes mention of the like Springs in Eubea, which are hot: and *Vitruuius* of the like at Hieropolis in Phrygia: Alſo *Ioſephus a Coſta* of the like hot Springs in Guaniauilica in Peru, which turnes to ſtone, whereof they build their houſes. *Anthonio de Herreza, cap.* 20. tels of the ſame Spring at Guainia velica, which turnes to ſtone as it riſeth, and kils thoſe that drinke of it. Alſo this *Succus lapideſcens* is obſerued in the Bathes of Apono, where it is conuerted into ſtone vpon the ſides of the Bath. Alſo in the Bath of Rancolani, where this iuyce is not confuſed, but perfectly mixed with the water, & being imbybed by plants, it hardens them like ſtone. *Baccius* tels vs of a Caue by Fileg in Tranſiluania, which turnes water into ſtone. The like is found at Glainſtaynes in Scotland, as *Hector Boetius* reports. In England alſo we haue many fountaines which turne wood into ſtone: which muſt be by reaſon of this *ſuccus lapideſcens* mixed with the water. Corall alſo being a plant, and nouriſhed with this iuyce, turnes to a ſtone: ſo doth the ſeede of Lithoſpermon or Gromell. Thus much of ſtone.

Lib. 6. c. 14.

Cap. 6.

Of Bitumen, His kindes, qualities. Of Camfor in particular. That Bitumen is predominant in the waters of Bathe.

NExt I come to thoſe Minerals which we call *Bitumina*, which are Minerall ſubſtances that burne and waſte in the fire without metallin fuſion, or ingreſſion. The greateſt affinity they haue, is with Sulphur: but this hath ingreſſion into mettall, and therefore I ranke it among the Spirits, and Bitumen hath none. Of this kinde ſome are ſolid, and ſome liquid. Solid, as *Succinum, gagates, ambra, camphora, terra ampelis, Lithanthrax, ſiue carbofoſsilis, &c.* Liquid, as *petroleum* and *naphtha*. All theſe are great fuels to fire, eſpecially thoſe that are liquid, which are thought to draw fire vnto them, if it be within their *effluuium*: So *Pliny* reports that *Medea* burnt *Creuſa* by anoynting her Garland with Naphtha: and *Strabo* tels how *Alexanders* Bathmaſter, *Athenophanes*, had almoſt burnt *Stephanus*, a boy in the Bath, by ſprinkling Naphtha vpon him, if it had not beene ſuddenly quenched. And this is that iuyce or thicke water which *Plato* in *Timeo* reckons among fires, and which the Egyptians vſed in their ſacrifices, and was hidden by the Iewiſh Prieſts in a dry pit for 70. yeares, and afterwards found by *Nehemias*.

Machab. 2. 1.

But whereas it is a common receiued opinion, that ſome of theſe *Bitumina* will burne in water, I cannot beleeue it: although *Pliny* and *Agricola*, and moſt that haue written ſince, out of them doe auerre it, and bring arguments and examples to proue it. For although water were a fewell to fire, as oyle is, yet there can be no fire without ayre, and water excludes ayre: and ſo doth oyle, if the fire be beneath it, and couered with it: As for their arguments, they ſay that Bitumen being beſprinckled with water, burnes more, and therefore water is a fewell to it: as we ſee that Smiths caſt water vpon their Sea-cole in their Forges: but the reaſon of this is, becauſe their Coale being ſmall like duſt, the water makes it to cake and bake together, where otherwiſe the blaſt would blow it away: alſo it hinders the quicke burning of it, and ſo makes it continue the longer: ſo in a *Vulcano* after raine, they finde the fire to burne more, when the Bitumen is ſmall, and in duſt. Although this may be a reaſon of it, that the Lyme which hath there beene calcined, being by raine diſſolued, increaſeth the fire. And whereas they ſay that water will kindle Bitumen, and quench Sulphur, it is not ſo: neither doth their example of Wilde-fire proue it. For in Wild-fire, beſides Bitumen and Campher, there is a double proportion of quicke Lyms, which by reaſon of the ſodaine diſſolution of his Salt, by the effuſion of water, is apt to kindle any combuſtible matter; not by reaſon of any Bitumen in the Lyme, as ſome imagine, nor of any *Empyreuma* which the fire hath left in it, as *Fracaſtorius* thinks: for, how can there be any Bitumen left in the Lyme (if there were any at firſt,) after calcination: the fire would haue conſumed that before any thing elſe. And as for any *Empyreuma*, it is certaine that the more any thing is burnt, although the fire leaue an aduſtion in it, the leſſe apt it is to burne againe, eſpecially being burnt and calcind *ad calcem aut cineres*, where all the combuſtible matter is ſpent. Wherefore it muſt needs be by the violent motion which is in the ſudden diſſolution of the ſalt in it, as appeares by the crackling it makes: *Et ex motu fit calor*. The like wee obſerue in *Pyrite ſterili*, whereof they make Vitrioll, which being

De ſympath. & antipath cap. 10.

broken and laid vp in heapes, and moyſtned with water, will gather heat, and kindle any combuſtible matter put to it. The like alſo wee finde in Allum myne, &c. where thoſe mineral iuyces being concrete in the Myne, when they come to ſuddaine diſſolution doe grow hot, and will kindle fuell. And as for the example of the ſalt Lake whereof *Agricola* writes, betweene *Strapela* and *Seburgh*, which burnes the fiſhermens nets if they bee put neare the bottome: and of the lake *Sputa*, in *Media*, mentioned by *Strabo*, which burnes clothes put into it: I take that to be by reaſon of the corroſiue quality of the ſalt which frets them, being ſtronger neare the bottome; and not from Bitumen, as *Agricola* thinks. The like I iudge of the Lake by *Denſtadt* in *Turingia*. And it is very probable that ſalt being heauier then water, will be moſt towards the bottome: as it is reported of the fountaine *Achilleus* in *Mileto*, whoſe water is very ſweet and freſh aboue, and very ſalt towards the bottome. So is the water of *Agnano* in *Italy*, as M. *Sandys* reports in his trauels. And the more heauy and terreſtriall any ſalt is, the more corroſiue it is: and ſo contrariwiſe, the more corroſiue, the more heauy. *Ariſtotle* affirmes the ſea water to be more ſalt at the bottome then aboue: and ſo doth *Pliny*, who likewiſe makes mention of the Lake *Aſcanius* in *Chalcide*, whoſe top is ſweet, and bottome nitrous. *Baccius* writes the like of a Well neare *Toletum* in *Spaine*, the water whereof is ſweet aboue, and corroſiue beneath: which he iudgeth to be from Quickſiluer. *Fallopius* is alſo of opinion, that Bitumen doth not only burne in water, but is nouriſhed by water, becauſe it makes the fire to laſt longer. But I haue ſhewed the reaſon of that before. And for the burning in water, he ſhould haue ſaid vpon the water; for there it wil burn as long as it ſwimmeth; but dip it vnder the water, and it is preſently extinguiſhed.

De nat cor. q. efflu. è terra. l. 4 c. 22.

Meteor. 2.

Lib. 2 c. 11.

De Thermis c. 5.

And whereas ſome report that Queene *Anne* of bleſſed memory, being in our Kings Bath, there aroſe a flame of fire like a candle from the bottome of the Bath to the top neare vnto her, they muſt giue mee leaue not to beleeue it, but rather to thinke they were miſtaken: for, I am not bound to beleeue any thing againſt reaſon, which God hath giuen mee to bee my guide. It might haue beene ſome bubble of winde which is frequent in our Bathes, or ſome Bituminous matter not diſſolued in the water, did ariſe, and being at the top, diſſolue it ſelfe vpon the ſurface in the forme of a circle: but it could not be kindled. And if it might bee kindled in the water (which were impoſſible) yet in all likelihood it would haue burnt better aboue the water then within it, and not be preſently extinct, as they report. Theſe *Bitumina* (excepting Camfer) are potentially hot and dry in the ſecond or third degree; but concerning Camfer there are two doubts. Firſt, whether it be a Bitumen or a Gum. Secondly, whether it be hot or cold. The Arabians affirme it to bee the Gum of a huge tree with white leaues, vnder whoſe ſhadow many wild beaſts may lye: and that after earthquakes there is great plenty found; that it is in quality cold and dry in the third degree; ſome late writers follow them in their opinion of a Gum, as *Mathiolus*, *Amatus Luſitanus*, *Garrius ab horto*, &c. *Platearius* holds it to bee the iuyce of an herbe. But we muſt conſider that they make two ſorts of Camfer, the one of *Borneo*, the other of *Chyna*. For that of *Chyna* they confeſſe it is adulterated with Bitumen: and that is the onely Camfer in vſe with vs. But that of *Borneo* to bee a ſimple Gum, and that a pound of this is valued as deare as an hundred pound weight of the other. So that all the doubt lyeth in this Camfer of *Borneo*; which whether it be a Gum

Seraphio de ſimp. m d.c.344. Auicen.lib.2. tract 1 c.2. Item l.2.tract 2.cap. 133. Item de med.cordial. tract.2.cap.3.

or no, is ſtill in controuerſie. For the Arabians not trading into thoſe parts, had the notice hereof onely from others, as *Serapio* and *Auicen* doe confeſſe: and *Amatus Luſitanus* ſaith that the inhabitants will not ſuffer ſtrangers to come aſhore to ſee it. So as wee haue beene kept in ignorance a long time from the true knowledge of it. And *Garrias ab horto* tels vs, that all his knowledge of it, is but by relation: himſelfe not being able to trauell to ſee it, partly by reaſon of his age, and partly for his continuall imployment about the Viceroy, yet he ſaith, that he had a piece of the wood giuen him: Onely *Eduardus Barboſa* reports that he did ſee the place in *Borneo*, and found it to be of a minerall nature. But *Barboſa* his teſtimony is not authenticall, hauing fayled much in other of his relations: as where he reports that the Purcelan of *China* is made of Oyſter ſhels, &c. Hee is contradicted by *Conſaluus Mendoſa* a man employed in thoſe parts by the King of Spaine, for ſuch diſcoueries, and alſo by *Hugo a Linſchoten*, a man of great obſeruation, and both of them of farre better credit then he. I procured ſome of that Camphir to bee brought from thence by my worthy friend Captaine *Beſt*, but whether it be a Gum or a Bitumen, by the view I cannot diſcern, But if it be a Gum, ſaith *Solinander*, why ſhould it abound more after earthquakes? and why ſhould it burne and not diſſolue in water? No Gums will burne, and all Gums will diſſolue in water: and earthquakes make no trees fruitfull, but may caſt forth minerals. That there is a naturall Bituminous Camphire, I make no doubt: and *Agricola* proues it ſufficiently: And the Bath in *Remandiola* neare *Rhegium* ſhewes it. Alſo the Well by *Muntzbach*, where *Taberni montanus*, ſaith there is minerall Camphir. *Auerroes* ſaith it is *affinis Bitumini*.

In Dioſcoridem Cap. de maſtich.

Lib.1.cap.9.

De nat. foſſil. lib.4.cap.2.

Theſaur. aquar. lib.1.cap.2.

I confeſſe that when I publiſhed my firſt edition, I was perſwaded by *Solinanders* iudgement, to thinke all Camphir to be a Bitumen, & namely that of *Borneo*, but ſince vpon better enquiry, I finde it otherwiſe. For Captaine *Beſt*, beſides the relations made vnto him in the Indyes, concerning this Camphir, that it was from a tree, hath alſo procured mee the teſtimony of Maſter *Andrew Cogganell*, vnder his owne hand, that both the Camphir of *Borneo* and *Sumatra*, are gums of a tree, and no Bituminous matter, himſelfe hauing beene at the gathering of it, and at the cutting downe of ſome of the trees. He hath alſo traded much in that commodity, and vented it at *Iapan:* where it ſeemes, as alſo at *Chyna*, they mixe and adulterate it with ſome other matter, to increaſe the ſubſtance, and abate the price: which mixture perhaps may be ſome Bituminous ſubſtance. This Maſter *Cogganell* hath liued 14. yeeres in thoſe parts, and ſpeakes the vſuall language, and hath beene often vpon that Iland of *Borneo*.

Now for *Solinanders* reaſons, they are eaſily anſwered: no Gums, ſaith he, will burne, and all Gums will diſſolue in water. I grant it, if you take the word Gum in a ſtrict ſenſe, for watry Gums, as Tragacanth, Arabicke, &c. But we vſe the word Gum in a more generall ſenſe, comprehending vnder it all Roſins, Turpentines, Pitches, &c. which being vnctious and oyly, will readily burne, and will not diſſolue in water. Among theſe Gums or Roſins, we reckon Camphir, and ſo that argument is anſwered. As for his other argument drawne from earthquakes, mentioned by the Arabians, after which there is commonly more plenty of Camphir: this doth not proue it to be a minerall; For earth-quakes are as apt to caſt vp freſh mould, whereby trees are made fruitfull, as minerals. Wherefore let vs ſubſcribe to the ancient Arabians, although they were not eye-witneſſes hereof, and to the later obſeruations of Spaniards and others: eſpecially now that we haue a countryman of our owne, who hath had as good meanes to learne the truth of this, as any European euer had: who is yet liuing, and able to giue ſatisfaction to any that are curious in theſe poynts.

Now for the qualities of it, the moſt generall and trueſt opinion is, that it is cold and dry. *Matthiolus* iudgeth it to be hot for three eſpeciall reaſons. Firſt, becauſe it burnes, and is a great fuell to fire. If this argument bee good, then flax, and ſtraw, and paper, and touchwood, and ſpunck ſhould be hot, for they are apt fuels to fire. Secondly, becauſe it is *odorata*, and hee holds all *odorata*, to be *calida: Galen* is of another opinion, and holds the iudgement of ſimples by ſauour to be vncertaine. And as for Camphir, *Galen* knew it not. *Auicen* ſaith expreſly of Camphir, that although it bee *odorata*, yet it is *frigida*. And if *Matthiolus* his reaſon were good, then Roſes and Violets, and Vinegar ſhould be hot; for they are *odorata*. It is true that all ſauors ariſe from heat, as *Galen* ſaith, and all compounded bodies haue ſome hot parts: but we ſpeake of the predominancy in the ſubiect, and of the operation it hath vpon mans body. Thirdly, becauſe it bytes the tongue. So doth iuyce of Limons, and Barberies, and Vinegar, &c. and yet they are cold. Wherefore I conclude our Camphir to be in quality cold and dry; and of very ſubtill parts. Theſe *Bitumina* being vnctious and oylie, diſſolue not of themſelues in water, without the helpe of ſome minerall iuyce, but may be confuſed with it. And wee haue many fountaines and lakes which participate with them. In Shropſhire at *Pitchford*, is a Spring that caſteth forth Bitumen ſwimming vpon the water. The like

Comment. in Dioſc & Epiſt. l. 3. Thaddæo Nemico.

De ſimpl med. facult. l. 4. c. 22.

Lib. 1. tract. 1. c

we reade of in *Auernia* in *France*, between *Claremond* and *Monſeran*, where the people gather it for their vſes. In *Italy* there are many fountaines, yeelding Bitumen; at *Maianum*, and *Saſſoli*, and *Salſa*, and *Herculanum* at the foot of the mountaine *Veſuvium*, at *Baia*, and alſo at the cape of S. *Helena*, and in the Iſle of *Woolſs* there are fountaines of pitchie Bitumen, which are vſed to pitch ropes and tackling, as *Ioſephus a Coſta* reports. And we haue that famous lake *Aſphaltites* in *Iudæa*, ſo full of Bitumen, that it hardly ſuffers any thing to ſinke in it. The riuer *Liparis* in *Cilicia*, by reaſon of a Spring neere *Solos*, is ſo full of liquid Bitumen, as they which ſwimme or waſh in it, ſeeme to be anoynted with oyle: Alſo there are Bituminous Springs in *Saxony* at *Bruno*, in *Swevia*, the lake *Tegera*, at *Gerſedorf* vnder the mount *Iurat*; In *Aſia* by *Tralleis* and *Niſſa*. Alſo in the Weſt Indies there are many found which they put to vſe for ſhipping. And this Bitumen is the chiefe ingredient in our Baths at *Bathe* in *Sommerſetſhire*, although diluted with much Niter, which makes the ſolution the better, and the water more cleare. That Bitumen is predominant in theſe our Baths, may bee proued by the effects, becauſe wee finde them exceedingly to comfort the nerues, ſupple the ioynts, dry vp rheumes, cure Palſies, and Contractions, being diſtinctly vſed, tinct ſiluer into the colour of gold, &c. Alſo by the Bituminous ſauour of them, and by the neighbourhood of Colemines in thoſe parts. All which doe argue Bitumen to abound in them. And whereas Doctor *William Turner* in his treatiſe of theſe Baths, thinketh Brimſtone to bee the chiefe minerall, and Copper next; I am not of his opinion. The actuall heat is no argument of Brimſtone, as ſhall be ſhewed when I come to that point: neither doth the ſauour bewray it. But his reaſon for Copper

Bellonius de Naphtha c.7.

Agric. de nat. eor. quæ efflu. è terra l.1.c.7.

is very weake. Hee ſound a Marcheſit vpon one of the hils, which he thought to hold Copper. But Marcheſits although they ſhew yellow, yet they ſeldome hold Copper, or any other metall. But his diſcourſe hath perſwaded *Iohn Bauhinus* to publiſh it confidently to the world. I ſhall haue occaſion to ſpeake more of this hereafter. And thus much of *Bitumina*.

De thermis Boll. l.3.c.61.

Cap. 7.

Of Minerall iuyces concrete: called by the Alchymiſts, Salts. The foure principall ſorts of them; Salt, Niter, Allum, Vitrioll.

Libauius in Syntagm.p. 121.

A Fourth ſort of minerals are concrete iuyces which are minerall ſubſtances diſſoluble in water. Theſe the Alchymiſts call Salts, and are the meanes of communicating all other minerals with water. For as water is apt to diſſolue and extract vegetables, ſo are theſe concrete iuyces apt to diſſolue and extract minerall ſubſtances. And although they are found ſometimes liquid being diſſolued by moyſture: yet we call them concrete, becauſe they will be concrete when the aduentitious moiſture is remoued. Our minerall Authors doe make many ſorts of theſe according to the ſeuerall minerals which they imbibe: but in truth they may bee all reduced to foure heads; Salt, Niter, Allum, and Vitrioll. And each of theſe hath diuers ſpecies, as *Geber* and *Cæſalpinus* ſay of Salt, *quot genera calcium, tot genera ſalium*. Concerning Vitrioll there may be ſome doubt whether it be a diſtinct ſpecies from Allum, and haue receiued onely ſome tincture from Copper, or Iron, or from ſome of their brood, which are called excrements. For in diſtilling oyle of Vitrioll, the lute wherewith the glaſſes are ioyned, will yeeld perfect Allum. And Vitrioll being boyld, ariſeth *in bullas* as Allum doth, and ſhoots like Allum *in glebas*; as Salt doth *in teſſeras*, and Niter *in ſtirias*. The ſhooting or roching of concrete iuyces, is worthy to bee obſerued, ſeeing euery kinde hath his ſeuerall manner or faſhion of ſhooting, whereby a man may ſee the perfection of each kinde. For example, if ſalt Peeter be brought you to examine whether it be perfect good or not, diſſolue it in water, and ſet it to ſhoot in a wooden diſh, or with ſtickes of Aſh, or other poreous wood: and if it ſhoot in needles, (*in ſtirias*) it is right. But if any of it ſhoot in ſquares or angles, or lumps, it is mixt, and vnfit either for medicine or Gun-powder. The common ſalt-Peeter being prepared and cleanſed with aſhes, hath commonly much of the ſalt of the aſhes mixt with it in the liquors, which being brought to ſhoot, will ſettle firſt vpon the wood in ſquares, (*in teſſeras*) and then the ſalt Peeter will ſhoot vpon it in needles. Theſe needles are good ſalt-Peeter, but the ſquares are other ſalt, and weaken the ſalt-Peter in his operation; the like you may iudge of other concrete iuyces. There are alſo certaine ſtones which we call *fluores*, which doe naturally ſhoot in diuers formes: as Chriſtall into ſixe ſquares (*in ſexangulos*) Sparr, which the Dutch call Sput or Querts, ſhoots into poynts like Diamonds: as wee ſee in thoſe Corniſh or Briſtoll ſtones: *oſteocolla* found by *Darmſtadt*, in the Palatinat, like bones: others like Oyſter or Muſcle ſhels, &c. The reaſon of this ſeuerall ſhooting in concrete iuyces and other minerals, is hard to giue. For if it did lye in the thinneſſe or thickneſſe, or clammineſſe of the matter whereof they were made, that difference were taken away when diuers ſorts are diſſolued together in the ſame water, for one would qualifie the other. But we finde that this mixt water will yeeld his ſeuerall ſalts diſtinctly, and all at once. So that it ſeemes, for the ornament of the vniuerſe, that nature hath ſo diſtinguiſhed theſe ſpecies, as it doth plants: among which ſome haue thicke leaues, ſome thin, ſome long, round, iagged, &c. ſome haue bulbous roots, ſome long, ſtringy, &c. So in their flowers, fruits, colours, ſmels, &c. euery kinde hath his owne faſhion. The reaſon hereof *Scaliger* ſaith cannot bee drawne from the Elements, nor from the thinneſſe, thickneſſe, clammineſſe, heat, cold, dryneſſe, moyſture, plenty, ſcarſity, &c. of the matter: but only from the forme, *anima*, ſeed, &c. which frames euery ſpecies to his owne figure, order, number, quantity, colour, taſte, ſmell, &c. according to the ſcience, as *Seuerinus* termes it, which euery ſeed hath of his owne forme. So alſo it is in minerals, which haue their ſeuerall and diſtinct ſpecies in nature, and their ſeeds to maintaine and perpetuate the Species. Now that theſe concrete iuyces are not bred commonly in theſe formes in the earth, the reaſon may be, either becauſe they are often intermixt with other minerals in their generation, or that their matter being plentifull, and roome ſcanty, they haue not ſcope to diſplay themſelues in their proper formes, or perhaps they want water to diſſolue them. But by artificiall preparations, wee finde theſe diſtinctions: in which it is doubtfull whether heat, or cold, or dryneſſe, doe procure this ſhooting or roching in concrete iuyces, and whether the ſame cauſes procure it in all. For dryneſſe it is certaine, that as moyſture diſſolues them, ſo dryneſſe congeales them: But dryneſſe being a paſſiue quality, is not ſufficient; it muſt be the action either of heat or cold, or both; and the right ordering of theſe will open a doore to the artefice of Bay-ſalt here in *England*, as well as in

In lib. de plantis Ariſtoteli aſcriptum lib. 2. paſſim.

France or *Spaine*, or the the Ile of *Mayo*. Among theſe concrete iuyces, *Agricola* reckons Sulphur, Bitumen, Auripigmentum, Sandaracha, Chriſocola, Ærugo, Myſi, Sori, Melanteria,&c. But if we examine them aright, we ſhall finde, that either they are not diſſoluble in water as concrete iuyces ſhould bee, or they are ſome of thoſe iuyces tincted or incorporated with other minerals. All theſe minerall iuyces are accounted hot, and dry, and aſtringent, and detergent, ſome more, ſome leſſe: and we take it ſo vpon truſt. But this point requires further conſideration and diſtinction.

Cæſalpinus de metallis c.3. l. 1.

Salt is a fixe ſubſtance, not volatill in the fire, aſtringent, detergent, purging, diſperſing, repelling, attenuating, makes an eſcar, and preſerues from putrifaction, as *Dioſcorides* informes vs, and *Galen* confirmes the ſame, adding that it is hot. But wee muſt vnderſtand *Galen* with his limitation, *lib. 6. cap.* 30. That the more it is deterſory, the leſſe it is aſtringent. And all aſtringent things are cold, as hee auoucheth, *lib.* 4. *cap* 6. *Acida, acerba, & aſtringentia omnia frigida.* Now if ſalt bee aſtringent, it muſt bee cold by *Galens* owne rule, and it is not enough to ſay it hath warme parts in it, but being an vniforme ſubſtance, wee muſt determine of it *ex predominio.* Alſo *Galen lib.* 1. *Symp. cap.* 4. comparing pure water with ſea water, ſeemes to affirme that ſea water, before it haue receiued any great aduentitious cold, may coole our bodies. And ſo this place is vnderſtood by *Anthonius Maria Venuſtus in conſilio pro Petro Picardo*, The repelling quality, and the making an eſcar, and the preſeruing from putrifaction, are arguments of drineſſe, and not of heat. For as heat and moyſture are principall agents in generation and corruption; ſo cold and drineſſe in preſeruation. Alſo I ſhould impute the purgatiue and deterſorie qualities in ſalt rather

Dioſc.l.5.c.84.
De ſimpl.med. facult.l.4.c.20. & l.11.c.50.

to the tenuity of parts, and the ſtimulation which it hath from thence, then to any heat; for then as *Sennertus* ſaith, all hot things ſhould purge; *Inſtit. lib.* 5. *part.* 1. *cap.* 11. *Valeriala in Gal. de conſtit, artis pag.* 447. And *Meſue Canon vniuerſal. cap.* 1. reiects all elementary qualities, temperaments, ſimilitudes, or contrarieties of ſubſtances, &c. in purging medicines. Alſo Tamarinds, Myrabolans, and Antimony doe purge, and yet are cold, *Venuſtus, pag.* 132. But the purgatiue faculty of medicines is from ſtimulation of the expulſiue faculty of the ſtomach and guts, and not from attraction by heat of peculiar humors, as hath beene imagined. Heat may ſerue as an inſtrument to actuate ſtimulation, as cold doth dull and benumbe all faculties, but neither heat nor cold are principall agents in this worke. And whereas Reubarb is thought to purge coller onely, Sene and Polipody melancholy, Agarick phlegme, &c. becauſe we ſee the excrements tincted with the ſame colours; it is a deceit; for theſe purgations doe colour humours in that manner. Yet I doe not deny a diſtinction to be made of purgations in other reſpects. And our ancient Phyſitians through long experience haue found out the right vſe of purging medicines, and their true diſtinctions for ſeuerall vſes for mens bodies: as that ſome doe purge groſſe humors, and ſome thin, ſome are ſtrong, and ſome weake: ſome are comfortable to the ſtomach, or liuer, or ſpleen, &c. and ſome hurtfull to ſome of thoſe parts: ſome are too hot in ſome caſes, and ſome temperate, &c. But they haue not diſcouered the true cauſe of this purging quality: ſome attributing it to a celeſtiall influence, ſome to a hidden quality, which is as much as if they had ſaid nothing: ſome to a Sympathy, Antipathy, &c. For my part I hold the purgatiue quality of mixt bodies to lie principally in the terreſtriall part of them, which is their ſalt: and therefore the Chymiſts vſe to acuate their purging extracts with their proper ſalts. It were much better if they could make their ſalts without calcination: for then they ſhould retaine the taſte of the Simples, which lyeth in the ſalt, and much other vertue which the fire conſumes in calcination. It were a delicate thing to haue all our vegetable ſalts to retaine the taſte of the hearbs and ſimples, from whence they are drawne: as of wormewood, bitter; of ſorrell, ſowre; of licoris, ſweet, &c. There are in mine opinion, three ſeuerall wayes for it, although they be laborious. The one is by precipitation, when the iuyce or ſtrong decoction of any ſimple is precipitated by the addition of ſome appropriate liquor which will ſtrike downe all other parts in the iuyce or decoction; but the ſalt which is in it will not eaſily precipitate, but will remaine in the liquor, and muſt be ſecured either by euaporation, or by roching. But in this worke we muſt make choyſe of ſuch a precipitator, as may not infect our ſalt with any ſtrange quality. Another way is to make an extract of the ſimple which we deſire to worke vpon, and when we haue made it ſo dry as it will be powdred, then powre vpon it pure ſpirit of wyne, which will diſſolue no ſalt, if it bee without phlegme. By this meanes through often repetitions of new infuſions, vntill the extract will yeeld no more tincture vnto the ſpirit of Wine, you ſhall finde the ſalt in the bottome, as a ſubſtance which the ſpirit of Wine will not worke vpon, nor diſſolue. A third way, as I conceiue, may be in manner of the working of ſalt-Peeter, by putrifying great quantities of the hearbs, vntill they become earth: and then by infuſions with water, to extract the ſalt, which will not putrifie with the hearb, but will remaine in the earth. The ſecond courſe

I haue tryed, the other wayes are very probable. In theſe ſalts doe lye the chiefe vertues of many ſimples, either for purging by ſtoole, or vrine, or for cleanſing, cooling, drying, ſtimulating, opening of obſtructions, attenuating of groſſe humors, aſtriction, corroboration, &c. according to the nature of the ſimples: whereas the other ſalts which are made by calcination, haue loſt theſe vertues by the violence of fire, and cannot be diſtinguiſhed the one from the other.

Niter is a volatill ſubſtance which doth dry and attenuate more then ſalt, & although it hath not ſo much aſtriction as Salt is ſaid to haue, yet it ſeemes to coole more then Salt, perhaps becauſe it is of thinner parts, and penetrates more, and that is the reaſon that it ſerues better for the diſſolution of Metals. In phyſicke we finde our Sal nitrum (which is a kinde of it) to coole the body mightily, and therefore vſed in Iuleps. Theſe niters alſo are apt to moue ſweat, eſpecially thoſe that are drawne artificially from mixed bodies, as from Boles, cordiall hearbs, Bones, hornes, Teeth, Clawes, Hoofes, &c. which are drawne by ſublimation. And theſe parts of animals are found to be very ſoueraign againſt venome and maligne humours. The reaſon of it I take to be, not onely the drying quality they haue, whereby they reſiſt corruption of humours, but alſo and principally by reaſon of their volatill ſalt or niter, whereby they moue ſweat, and expell from the center of the body. For all their ſalt is volatill, as may appeare by this, that you can neuer make any *lixiuium*, out of any of theſe animal medicines, by calcination, as you doe out of vegetables; their ſalt being altogether euaporated by the fire. This volatill ſalt being taken into our bodies, and actuated by our naturall heat, is commonly very Diaphoreticke: & this is it which makes our Bezoar ſtones, *contra yerua*, *vngula del Bado*, and ſuppoſed Vnicornes horne to be in ſuch eſteeme.

Sal ammoniacum, is alſo a kinde of niter, and volatill, and ſo is Borax and Alrincar: but theſe are commonly mixed with *Sal alkali*, and Vrin or Vinegar, and ſo made more fix. There is alſo a naturall Fix borax found in the Ile of *Lambay* neere *Dublin* in *Ireland*, which perhaps the Sea water hath fixt. Allum and Vitrioll are much alike, but that Vitrioll hath a garbe from Copper or yron. Theſe are very aſtringent, and without doubt cold, whatſoeuer hath beene held of them. The waters or phlegmes diſtilled from them, doe exceedingly coole in Iuleps, as *Quercitan* and *Claudius Dariot*, haue obſerued, and we alſo by daily experience doe finde true; by reaſon of the intenſe aciditie they haue, being diſtilled from their Terreſtriall parts. Alſo thoſe *acidula* which the Germans call Saurbrun, proceeding from theſe iuyces, are much vſed to quench the heate of feuers. It may be obiected, that they are corroſiues, and will eate into metall, and therefore muſt bee hot. But by the ſame reaſon, the iuyces of Limons, Barberies, Howſleeke, &c. ſhould be hot, for they will carue iron. To bite and eate as a Coroſiue, are not arguments of heate, but of piercing. Wherefore *Hippocrates* ſaith, *Frigus vlceribus mordax*, and *frigus eſt principium deſtructiuum, vt calor generativum.* And therefore it is more probable that theſe corroſiues are more cold then hot. Theſe two minerall iuyces are not ſo readily diſſolued in water, as the other two, and will bee more eaſily precipitated by any oppoſite ſubſtance that is more familiar to water. I omit the ſeuerall ſorts of theſe concrete iuyces and their admixtures with other minerals, as impertinent to my purpoſe: wherefore I will ſhew ſome examples of each of them in naturall Springs.

In peſtis Alexic. Dariot de præparat. med. Tract. 2. cap. 23. 24.

Lib. de Humidorum vſu.

For ſalt Springs, *Ioſephus a Coſta* tels vs of a rare Spring at a Farme neere Cuſco in Peru, which as it runs, turnes into very white ſalt, without any fire or Art, in great abundance. In Germany are many ſalt fountaines, at Luneburg, Stafford, Saltzburg, Aldondorf, Halſtat, &c. In Italy, *in agro Volaterano*, &c. In Cicily, at Solinantia, is a ſalt Well which is hot; and ſo are the Pegaſæi fontes in Caria. Alſo the fountaine by Medon in Træſen is both ſalt and hot. Our Wiches in Cheſhire are well knowne. There are alſo Riuers of ſalt water by the Caſpian ſtreights, and in Spaine, and Caria, and in Bactria, Ochus and Oxus. Alſo there are ſalt Lakes, as the Terentin Lake in Italy, the Lake betweene Strapela and Seburg (mentioned before) In Germany, three Lakes in Cicily, and beſides an infinite number in other Countries, the Lake of Lakes, the Sea. All which receiue their ſaltneſſe from Mynes of ſalt in the earth, which are very frequent and huge in bigneſſe, as may appeare by the Rocks of Salt in Bohemia, in monte Carpato, in Polonia, within two miles of Cracouia, in Heluetia, and Rhetia, where they haue no other ſalt but from the Rocke. As alſo by the Caſpian Straights, are great Rocks of Salt. But *Marcus Paulus Venetus*, tels vs of a Rocke or Mountaine of Salt in *Thaican*, able to furniſh all the world with Salt. So that it is no maruaile that the Sea is ſalt, ſeeing it pierceth into the bowels of the earth, and diſcouereth many great Rockes of Salt which diſſolue in it. And this is the true cauſe of the ſaltneſſe of the Sea. The other cauſes alleadged for it, are very improbable. For whereas *Ariſtotle* and his followers attribute the ſaltneſſe of the Sea, to the euaporation of the freſh and ſweet parts of the water, by the Sunne, and to an aduſtion procured alſo thereby: I anſwer, that neither the one nor the other

*Lib.*3.

can breed a ſubſtance in the water, which was not there before. For qualities can breed no ſubſtance, and aduſtion is but a quality imprinted, and no ſubſtance. Neither can euaporation breed any,but onely diſcouer that which was in it before, by taking away the thin parts, and leauing the terreſtriall behinde. But we ſee the Sea-water to containe in it the ſubſtance of Salt,and moſt of the ſalt which we vſe is made of Sea water: and no man will deny that this Salt is differing from water in his ſubſtance and generation, being a diſtinct ſpecies in it ſelfe. And whereas they alledge for confirmation of their opinion, that vnder the torrid Zone, the Sea is more ſalt then in other parts, the Sunne exhaling more there, and making a greater aduſtion: I doubt it, both for the large and plentifull riuers which thoſe parts afford, beyond any other parts of the world, and alſo for that the Sea water there is not hot, neither are the beames of the Sunne ſo hot, but that men doe endure them: and therfore not likely to breede an aduſtion in the Sea water, which muſt firſt be hot, before it be aduſted. Alſo it may be that thoſe parts doe abound in rockes of Salt, as we reade of people in Affrica, called *Ammantes*, who make them Houſes of rock-ſalt, and Caſtles, as that in Sinu Geraico, which is fiue miles in compaſſe, and all of Salt: alſo the mountaine Oromenus in India is all of Salt. Moreouer if the Sunne be able to doe this in the Sea, which is alwaies in motion, whereby it alludes the force of the beames; why ſhould it not doe the like, and much more in ſtanding Lakes, as the Lemanus and ſuch like? They anſwer that Lakes are continually ſupplyed and fed with freſh water from Springs. But ſo is the Sea continually fed with freſh water, and in as large a proportion, *cæteris paribus*, as Lakes are. For as the Sea is not increaſed by the influx of freſh waters, no more are

Aliquid aquæ admixtum Ariſt. 2. Meteorol. cap 3.

diuers Lakes, but keepe the ſame fulneſſe, and ſometimes are leſſened. And whereas they ſay that the vpper part of the Sea is more ſalt then the bottome, they ſpeake againſt all reaſon, Salt being heauier then water, and againſt experience, as I haue ſhewed in the former chapter. Alſo *Ariſtotle* in ſome places confeſſeth it. But *Meteor. 2.c.3.* if any man will take the paines to vapour away 100. tunne if he will, of freſh water, I doe aſſure my ſelfe hee will not finde one graine of ſalt at the bottome, if it were not in the water before. This may be tried alſo in any diſtilled water, which we are ſure can haue no Salt in it, (for Salt will not ariſe in diſtillation) and is as apt to yeeld Salt as any other water, if aduſtion or euaporation would breed it. Wherefore the ſaltneſſe of the Sea is not from euaporation or aduſtion, but muſt needes proceed from rocks of ſalt in the earth, which the Sea doth waſh, and diſſolue much of it. And conſidering the great vſe of Salt, both for other vſes, and for generations, nature hath prouided enough of it, eſpecially in the Sea, which is more fruitfull in that reſpect, then the Land. Wherefore *Venus* was called Αλιγενὴ: *Eſt Venus orta Mari.*

Niter is ſeldome found in Bathes alone, but mixt with other minerals, which it diſſolues, and infects the water withall. Yet wee reade of a nitrous Lake called Letis, neere Caleſtria in Macedonia, where they vſe to make Niter, and vent it to all parts. So they doe at the Nitrarie in Egypt. Alſo the Lake Arethuſa in Armenia, is full of Niter. At Menis in Phrygia is a Spring of nitrous water which is hot: alſo in Leonte is a hot nitrous Spring. *Bellonius* makes mention of a Nitrous fountaine *Obſeruat. l.3. c.76.77.* neere Belba, and of abundance of Niter vpon a Plaine neere thereunto, which ſeemes to be that which *Pliny* cals Halmiraga. But he denieth that there is any Mine of Niter vnder the earth, but that all is bred out of the ſoyle as an *effloreſcens* of the earth: *Baccius* ſaith the ſame of Salt-peter. Lib.5.c.7. *Agricola* ſaith, that as the true Niter is gathered vpon the Playnes of Media aboue the earth, ſo is Salt-peter found aboue the earth in many places of Saxony: That Niter is gathered vpon the Plaines of Media, are *Plinyes* owne words. Lib.31.c.10. *Exiguum fit apud Medos caneſcentibus ſiccitate conuallibus.* So that it ſeemeth, his opinion was, that Niter is not bred in a Myne vnder the earth, as *Geſner* alſo ſaith, *Epiſt. lib.* 3. *pag.* 134. but in the earth it ſelfe, as the chiefe fatneſſe it hath to further generations. And ſeeing earth is the mother of all Terreſtriall bodies, it is not left vnfurniſhed with thoſe minerall iuyces, nor ought elſe that is requiſite for the production of ſpecies: It hath beene obſerued by ſome, that nitrous water is the beſt ſoyle for ground, and brings all Plants to perfection farre ſooner then any other dung, and therefore the Egyptians water their Coleworts with Nitrous water, *Nitroſa viridis braſsica fiet aqua.* Martial. Our Salt-peter men doe finde, that if any fat earth be couered from raine and ſunne, ſo as it ſpendeth not his ſtrength in producing of Hearbs or Graſſe, it will breede plenty of Salt-peter, otherwiſe it will yeeld none. The difference betweene Salt-peter, and the ancient Niter, appeares in this, that a pound of Niter being burnt, will leaue foure ounces of aſhes; Salt-peter will leaue none. Salt-peter is actually ſo cold, as being diſſolued in water, it is vſed in Rome and Naples to coole their Wine, and doth it as well as yce or ſnow. Alſo we vſe it inwardly in cooling Iuleps, and therefore it ſeemes alſo to be potentially cold, as *Bellonius* iudgeth.

Now I come to Allum (*Indignum vox ipſa iubet renouare dolorem*) the greateſt debter I haue, and I the beſt benefactor to it, as ſhall appeare when I ſhall think fit to publiſh the Artifice thereof. In Illua, a mile from Rio, is an Allum fountaine: alſo there are diuers in Agro Senenſi, Volaterano Lucenſie, in Italy, *Balneum de villa* is full of Allum: and with vs in Shropſhire at Okenyate, are Allum ſprings, whereof the Dyers of Shrewesbury make vſe in ſtead of Allum. As for allum Mynes, they are frequent almoſt in all Countries, but the chiefeſt that are wrought, are at Capſylar in Thracia, at Tolpha neere Ciuita Vecchia in Italy, at Commatow by Auſſig in Germany, and with vs in Yorkeſhire. In Ireland there haue beene allum workes neere to *Ar*magh, as *Thurmiſer* reports: alſo at Metelin in Spaine, at Mazaron neere Carthage, at Helleſpont, Maſſa, Montrond, Piambin, Volterra, Campiglia, &c. as *Beringaccio Sieneſe* reports. Alſo there are diuers earths yeelding allum, as at Guyder in Carnaruanſhire, at Camfurt in Dorſetſhire, and in the Iſle of Wight. But I will contract my ſelfe for allum, and come to Vitriol.

Pyrotechnia l.2.c.6.

Vitriol, as I haue ſaid before, doth participate much with allum in the manner of ſhooting or roching, which is *in glebas*, in the hard diſſolution and eaſie congelation, in their ariſing in bullas being burnt, and in their precipitation: in ſo much as it is probable, that the baſis of Vitriol, is nothing but allum. It is found in minerall waters of two ſorts. The one, where the very body and ſubſtance is diſſolued: as in Cyprus, which *Galen* deſcribes, where the water is greene: alſo at Smolnicium in Hungary, in Tranſiluania *ad Carpatum montem*, at Nenſola, &c. In which places Copper is ordinarily made out of iron by infuſing it in theſe waters. I will not determine whether this be tranſmutation of one ſpecies into another, as ſome doe hold, or rather a precipitation of the Copper which was formerly

Simp. med. facul. l.9 c.61.

Libau. in Syntag. 3. part. l.7. Item ſingularium part. 1.

diſſolued in the water by meanes of the ſharpe Vitriol; which meeting with Iron, corrodes it, and imbibeth it, rather then the Copper, and ſo lets the Copper fall, and imbraceth the Iron in place of it. We daily ſee the like in Aqua fortis, which hauing imbibed one metall, will readily embrace another that is more familiar to it, and let fall the firſt. So allum or Coppreſſe water hauing ſome ſtrong Lixiuium of Tartar or other calcind ſalt put to it, the allum or Coppreſſe will preſently fall to the bottome, and precipitate and giue place to the Lixiuium, as a thing more familiar to water, and of more eaſie diſſolution. But as I ſaid, I will not determine this queſtion, becauſe it is not much pertinent to our buſineſſe. Yet I will not omit the iudgement of *Lazarus Ercker* the Emperours chiefe Mine-maſter in the Kingdome of Bohemia, who profeſſeth that he was long of this opinion, but altered it vpon this reaſon; That by exact proofe hee found more Copper ſtricken downe this way by Iron, then the water before did containe, and with the Copper ſome Siluer. The other kinde of Vitriol water is, where not the body and ſubſtance of Vitriol is diſſolued, but the ſpirit, or vapour, or quality communicated to the water: of this ſort are our Vitriol Baths for the moſt part. And theſe are in themſelues wholſome, and are ſowre, if the Vitriol be predominant. Such are moſt of our *Acidulæ*; whereof we haue many in *Viterbio & Volaterano*, *Balneum ad morbum dictum*, Saurbrun by Franckford, *ad oderam*, &c. There are ſowre waters alſo from Allum, but milder, alſo from Sulphur, whoſe ſpirit or vapour being burnt, is little differing from the ſpirit of Vitriol, but ſomewhat fatter. But the moſt part of our *Acidulæ* are from Vitriol. This ſowre ſpirit of Allum, Vitriol, or Sulphur, *Libanius* iudgeth with *Thomas Iordanus* to be in the terreſtriall

Lib. 3. Von. Kupffer ertz.

Io. Bauhinus de thermis l. 2. c. 2.

De iudicio aqu. r. p. 2. c. 36.

ſtriall parts of theſe minerals, becauſe it goeth not away by boyling or diſtillation, and therefore to be communicated with water by the corporall ſubſtance or iuyce of them. But that holds not in minerall ſpirits which are heauier then water, as may appeare by euaporation of any water made ſowre with ſpirit of Vitriol or Sulphur, where, after long euaporation, that which remaines will be more ſowre then before euaporation. So it is alſo in Vinegar, being a vegetable iuyce. The ſpirit of wine doth certainly ariſe firſt in diſtillation, and the firſt is the beſt, being more volatill then the vapour of water. But this *ſpiritus acetoſus* which is in Sulphur, Allum, Vitriol, and Vinegar, ariſeth laſt; and the more you diſtill away from it, the ſharper it ariſeth, and the ſowrer is that which remaineth. Thus much for Vitriol and concrete iuyces.

CAP. 8.

Of minerall ſpirits. Quickſiluer, Sulphur or Brimſtone, Arſenick, with his kindes, Cadmia.

A Fift kinde of minerals are called ſpirits; theſe are volatill in the fire, and haue ingreſſion into metals, but no metallin fuſion. Theſe are Quickſiluer, Sulphur, Arſenick, Cadmia, Ruſma, &c. All which being volatill will eaſily ſublime, and being mixed with metals, as Cadmia is ordinarily to make Braſſe, will alter the colour of the metall, and make it leſſe fuſible, and leſſe malleable. I will briefely run ouer the examples of theſe and their vertues or qualities, being more obſcure, and in our Bathes leſſe vſefull then the former, and more rare.

Quickſiluer was not well knowne to *Galen*, for he *Simpl.med.facult.l.9.c.19.*

confeſſeth that hee had no experience of it, and did thinke it to be meerely artificiall,and not naturally bred in the earth. *Dioſcorides* makes no mention of the temperature of it, but holds it to be a pernitious venome, and to fret the entrayles: although *Mathiolus* affirmes that it is ſafely giuen to women to further their deliuerance,and we find it ſo by often experience,both in that cauſe, and in Wormes, and in the French diſeaſe and Leproſies,if it be skilfully prepared, and with iudgment adminiſtred. *Fallopius* holds it to be one of the miracles of nature. Thoſe that take vpon them to determine of the qualities of it,are much diſtracted; ſome reckoning it to be hot and dry,and ſome cold and moiſt;and both in a high degree. But in this account they conſider not the qualities of the ingredients in the preparation; whether it be ſublim'd or precipitated. For my part I know not how to reduce it to the Elementary qualities: neither am I aſhamed of mine ignorance in it, ſeeing no man hitherto hath giuen true ſatisfaction herein. And if it be true that the elements doe not concurre to the generation of mixt bodies, (as I ſhall ſhew, *cap.* 11.) we need not maruaile if we finde them not, where they be not. But for our owne vſe, where reaſon failes vs, let vs be guided by experience. We finde by experience, that it cuts, attenuates, penetrates, melts, reſolues, purges both *ad centrum & à centro*, heats, cooles, &c. and is a tranſcendent beyond our rules of Philoſophie, and a monſter in nature, as *Renodæus* ſaith. For our purpoſe it is enough to know whether it will impart any qualitie to water; which *Fallopius*, *Baccius*, *Solinander*, *Bauhinus*, and *Felix Platerus* doe acknowledge. But it giues no taſte to it, neither haue we many examples of Baths which containe it. In Serra Morena in Spaine, neare the village Almedien, is a Caue, where are many Wels, in-

Vidus Vidius curat. generatim p.2. ſect.2. l.3. c.13.

Fallopius de metallis c.37.

fected (as is thought) with Quickſiluer, becauſe much of that minerall is extracted from thence, out of a red ſtone called *Minium nativum.* About fifty miles from thence in Valentiola, there is another fountaine called La Naua, of a ſharpe taſte, and held to proceede from Quickſiluer, and theſe waters are found wholeſome. So are the waters at Almagra and Toletum, and others by the riuer Minius, which are hot. There are many venomous ſprings attributed to Quickſiluer, as the red fountaine in Ethiopia, others in Boetia, Cæa in Trigloditis, Stix in Archadia, Stix in Theſſalia, Licus in Sicilia, &c. which perhaps are from other minerals, ſeeing wee finde ſome from Quickſiluer to be wholſome. For mines of Quickſiluer, we reade of many in Bætica, Attica, Ionia, out of a ſtone which *Pliny* cals *vomica liquoris æternis.* In Germany at Landsberg, at Creucenachum, Schenbach, Baraum aboue Prage Kunningſtien, &c. In Scotland, three miles beyond Barwicke, I fonnd a red ſtone, which I take to be *minium nativum*, ſeeing *Agricola* makes mention of it in Scotland, but by a miſchance could not try it.

Sulpher attracts, contracts, reſolues, mollifies, diſcuſſes, whereby it ſhewes a manifeſt heate, though not intenſe, yet the fume of it is very ſoure, and therefore muſt coole and dry: and I perſwade my ſelfe that there is no better fume to correct venomous and infectious ayre, then this of Sulphur, or to remoue infections out of roomes, clothes, bedding, veſſels, &c. We muſt acknowledge differing parts in all compounded bodies; as Rubarb hath a purgatiue qualitie in the infuſion, and an aſtrictiue in the Terreſtriall ſubſtance, where the ſalt hath beene by infuſion extracted. The ſubſtance of Sulphur is very fat (*Sulphure nihil pinguius*) ſaith *Felix Platerus*) and this is the cauſe of his eaſie taking of fire, and not any propinquity it hath with fire in the qualitie of heate: for if it were very hot, *Dioſcorides* would not commend it *purulenta extuſsientibus*, the next dore to a Hectick. Alſo *Galen* ſaith, that fat things are moderately hot, and are rather nutriments then medicaments. Now for Sulphurious Bathes, they are very frequent, and if we ſhould beleeue ſome, there are no hot Bathes, but participate with Sulphur, but they are deceiued, as ſhall appeare hereafter, when wee come to ſhew the true cauſes of the heate of Bathes. Neither are all ſulphurious Bathes hot. *Geſner* reports of a Bath by Zurich, very cold, and yet ſulphurious. *Agricola* of another by Buda in Pannonia. In Campania by the Leucogæan hils, are cold Springs full of Brimſtone. Alſo there are hot Bathes without any ſhew of ſulphur that can be diſcerned, as the Bathes of Petriolum in Italy, the Bathes Caldanellæ and *de Auinione in agro Senenſi de Gratta in Viterbienſi, de aquis in piſanis collibus, Diui Iohannis in agro Lucenſi in Alſatia*, another not farre from Geberſallerum, &c. All which are very hot, and yet giue no ſigne of Sulphur either by taſte, or ſmell, or effects. And yet no doubt there are many Bathes hauing a Sulphurious ſmell from other minerals; as from Bitumen, Vitriol, Sandaracha, Allum, &c. which are hardly to be diſcerned (if at all) from Sulphur. So wee commonly ſay, if a houſe or a tree bee ſet on fire by lightning, that it ſmels of Brimſtone, when there was no Brimſtone there. Many things combuſted, will yeeld a nidorous ſmell, not diſcernable after burning, what the things were. But there are diuers truely Sulphurious Baths which containe Sulphur, although not perfectly mixt with the water without ſome *medium*, but onely confuſed: for perfect Sulphur will not diſſolue in water, no more then Bitumen. The ſpirit of Sulphur may bee communicated to water, and ſo may the matter of Sulphur before it hath attained his perfect forme and conſiſtence: otherwiſe it is onely confuſed with water, and alters it into a milky colour. *Sulphurea Nar albus aqua.* At Baia are diuers hot Sulphurious Baths, and euery where in Hetruria; in Sicily, *in Dioceſi Panormitana*; the Baths of Apono, as *Sauanarola Muntagnana*, and *Fallopius* auers, although *Iohn de dondis* denieth it, the Bath of Aſtrunum, of Callatura, S. Euphemie, Aquiſgran, *Brigenſes thermæ in Valeſijs Heluetiorum*, *aqua ſancta in Picenis*, and an infinite number euery where. *Baccius* reckons our Baths of *Bathe* among Sulphurious Baths, from the relation of *Edward Carne* when he was Embaſſadour to *Iulius tertius*, and *Paulus quartus*. I will not deny ſome touch of Sulphur in them, ſeeing we finde among Bituminous coales, ſome which are called metall coales, with certaine yellow vaines which are Sulphur. But the proportion of Sulphur to Bitumen, is very little; and therefore I doe not hold them Sulphurious *à prædominio*. This is enough for Sulphur.

Concerning Arſenick, it is a venomous minerall, and therefore I neede ſpeake nothing of the Bathes which proceede from it, but that wee take heed of them; It is likely that thoſe venomous waters and vapours which kill ſuddenly, doe proceede from Arſenicke, as at Cicrum in Thracia, *fons Neptunius in Terracina*, at Peraut by Mompelier, *the Lake Auernus. The caue of Charon by Naples.* Vnder Arſenicke wee may comprehend Auripigmentum, Riſagalum, Sandaracha, Ruſma, &c. I heare of but one Mine of Ruſma in Ciprus, from whence the Turkes haue it to take off hayre, and it doth it beſt of any thing knowne, as *Bellonius* and *Platerus* report, and I haue made tryall of it oftentimes: The former ſorts of Arſenicke are found *in Miſsia Helleſponti in*

Ponto, by the Riuer Hippanis, which is made bitter by it. In the leſſer Aſia, betweene Magneſia and Eupheſus in Carmania, &c. It is accounted to be extreame hot and putrifying.

Cadmia is either naturall or factitious: The naturall is often dangerous in Germany, as *Agricola* ſaith, eſpecially that which is liquid, which is a ſtrong corroſiue: the other is of the nature of Copper, moderately hot and clenſing, and eſpecially good to cleere the eyes, as Calaminaris and Tutia. It is found in Copper Mynes, and of it ſelfe in Cyprus, as *Galen* ſaith by the Citie Solos: Alſo in *Agro Senenſi, vicentino, Bergomenſi*, neere Como, where they make Braſſe with it. Vnder Mendip hils there is much of it. The Bathes of Saint *Caſſian* doe participate with it, and *Cicero* his Bathes neere Baia. Alſo the Bath at Zurich in Heluetia, and Grotta in Viterbio.

Thus much for Spirits.

CAP. 9.

Of meane metals, or halfe metals. Biſmutum or Tinglaſſe. Antimony. Bell-metall.

A Sixt ſort I make to be meane metals, or halfe metals, which are minerall ſubſtances, hauing metalin fuſion, but are not malleable as metals are: and therefore being mixt with metals, doe make them brittle. Theſe are *Biſmutum*, or *plumbum cinereum*, Anthimony, Bell metall, which *Gaber* cals *Magneſia*, in Dutch, *Speiſſ*. Calaem alſo may be reckoned among thoſe, which is a kinde of white metalin Cadmia, brought out of the Eaſt Indyes, which hath both metallin ingreſſion, and metallin fuſion, but not perfectly malleable. Theſe although they are more volatill then metall, yet by reaſon of their fuſion into a King, are not ſo eaſily ſublimd as the Spirits.

Biſmutum is that wee call Tinglaſſe, differing both from Tin and Leade. *Candidius nigro, ſed plumbo nigrius albo.* It was not knowne to the Ancients, and therefore we can ſay little of the qualities of it. It is found in England, and in Miſnia, and at Sneberg in Germany, and in very few places elſe. I reade not of any waters that participate with it: neither can I ſay much of Antimony, but that *Dioſcorides* ſaith it cooles, bindes, opens obſtructions, &c. And *Galen*, that it dryeth and bindeth, and is good for the eyes, &c. But of the purging qualitie they write nothing, although we finde it to purge violently, both vpwards and downewards: whereupon wee may gather that all purging medicines are not hot, as I haue touched before. *Camden* ſaith there is a Mine of it in Cumberland: It is found in Italy, *in Thinni montibus, in Senenſi agro* in the Countie of S. Flora, and in Germany in many places. But I reade of no waters that participate with it, vnleſſe wee ſhould iudge all purgatiue waters to be infected with it: as neere Ormus, *Purchas* writes of ſuch a Spring which purgeth. *Sauonarola in Balneis Romandiola*, mentions a Spring at Meldula, which purgeth. Alſo *Balneum Tertutij in agro Piſtorienſi, Fallopio*; alſo the ſowre water of Mendich and Ponterbon doe purge choler, as *Rulandus* ſaith. At Noneſuch we haue alſo a purgatiue Spring, which may participate with Antimony or Niter, or both: But purgatiue waters are rare, vnleſſe it be *ratione ponderis*, by the weight and quantity, and ſo any water may purge, and our Bath waters doe purge in that manner, and by the addition of Salt, which giues ſtimulation vnto it. This our Bath guides doe ordinarily preſcribe to

Parte 3 *pag.* 72.

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Fallop. de metallis cap. 10. Libau de mineral. part. 2. cap. 7.

Parte 3 pag. 72.

ſuch as will be perſwaded by them, not knowing how it agreeth with their griefes, nor how it may doe hurt in many reſpects, as oftentimes it doth.

Bell-metall is thought to be a mixture of Tinne and Copper Oares, as *Kentman* iudgeth, and is found in our Tinne and Copper Mynes in Cornewall. I reade of no waters infected with it, nor of any vſe it hath in Phyſicke.

CAP. 10.

Of metals: Gold. Siluer. Iron. Copper. Tinne. Leade.

Fallop. de metallis cap. 10. Libau. de nat. metall. part 3. cap. 5.

THe ſeuenth and laſt ſort are metals, minerall ſubſtances, fuſible and malleable. Theſe are commonly diſtinguiſhed into perfect and imperfect; perfect, becauſe they haue leſſe impuritie or heterogenitie in them, as gold & Siluer. The reſt are called imperfect, becauſe they are full of impurities, and they are either hard or ſoft. Hard, as thoſe which will indure ignition before they melt, as iron and Copper: Soft, which will not, but melt at the firſt, as Tinne and Lead.

All theſe metals are found in his Maieſties dominions, and many of them I perſwade my ſelfe, might bee wrought to better profit, if our Smelters were skilfull, or were not hindered by ſiniſter reſpects. But eſpecially we abound in the imperfect metals more then enough to ſerue our owne vſe. And for the perfect metals, I haue ſeene both in Cornewall, and at Crayfordmuir in Scotland, perfect gold (which the Dutch call Gedigen) in grayns among Sparr. Alſo among other metals, it is ordinarily bred, as Iron, and Copper, and Tinne. But from Tinne it is hardly ſeparated without more waſte of Tinne then the gold is worth. From Iron and Copper I ſee no reaſon but it might be ſeparated with aduantage.

For ſiluer, there is much loſt for want of taking it forth of Lead Oares. For whereas thoſe Oares which are rich in ſiluer, are commonly hard of fuſion; our minerall men either neglect thoſe Oares, and worke them not, or elſe they mixe ſome ſmall proportion of them with their poore Oares, which are eaſie of fuſion, and ſo make the metall ſo poore, as it is not worth the refyning. Whereas if they were wrought by themſelues, they would yeeld in ſiluer vpon euery tunne, ſome 20. ounces, ſome 40. ſome 60. ſome 80. more or leſſe.

For Copper, whereas we fetch our Pinnes and Tags of Poynts from other Countries, yet no doubt wee might be furniſhed of our owne, both for theſe and other vſes. We haue but one Copper worke that I heare of in all his Maieſties Dominions, and that is at Keſwick in Comberland: but Copper Mynes are found in diuers other parts, as in Cornwall at Treuaſcus, and other places in Yorkeſhire, Scotland, Ireland, &c. And no doubt, many are concealed, by reaſon they are Mynes Royall. If theſe were wrought, and wrought after a good manner, it is likely they would bring a good aduantage to his Maieſty, and to the Kingdomes.

For iron, wee haue the Oare in abundance, but it is pitty that ſo much good wood ſhould be waſted vpon it for ſo bad iron; and yet the gold which it holds, is loſt. Many haue propounded the melting of it with ſtone-coale, but perhaps they haue failed in their proiects: yet this doth not proue the impoſſibilitie of it. And for the goodneſſe of this metall, if it were rightly made, it would melt as readily as other metall, and would be tough, and not ſo brittle as it is, and would not be ſo apt to ruſt. For theſe inconueniences happen to it for want of ſeparation of the impurities which are bred with it.

For Tinne, wee haue as good as any in the world; although it is not wrought to the beſt aduantage. The Countries where it growes, are barren of wood, and they are faine to fetch it farre off. Now if it were wrought, as I know it may, by many experiments which I haue made vpon it, with ſtone-coale, there would bee much ſaued, and the wood might bee otherwiſe employed. The Tinne alſo would be as good as now it is, and the product not diminiſhed.

For Lead, although for ſoft Oares the ordinary courſe of melting at Mendip and the Peake, may ſerue well, and much better then their Baling at Alendale in Hexamſhire, and at Graſſe in the Biſhopricke of Dureſme: yet for hard Oares (which are commonly rich in ſiluer) there might bee better courſes taken, by common or proper Agents. Common agents are fire and water: proper are diſſoluents or additaments. By fire they might amend their working, if they did roaſt their Oares well before melting, to breathe away volatill and combuſtible ſubſtances which are mixed with their Oares. By water, after calcination or roſting, they may ſeparate all diſſoluble iuyces, &c.

Diſſoluents doe chiefely ſerue to ſeparate the ſiluer or gold out of the Oares: as in the quickſiluer worke, or by Lyes of Niter, Allum, Salts, &c.

Additaments are alſo of great vſe, whether they bee ſegregatory for ſeparation of ſpirits, or meane metals from our Oares, and ſo to facilitate their fuſion: or propugnatory to defend the Oares from conſuming or vitrifying. Segregatory additaments are either ſuch as are more eaſie of fuſion then the Oare, and ſo draw the Oare into fuſion with them, or ſuch as will not melt at all, as

Geber ſaith, *Cuius intentio non ſit fundi*: which keepes the Oare aſunder from clodding, and giues it a greater heat, like fire in his boſome. By theſe meanes well applyed and vſed, all Lead Oares might be wrought, bee they neuer ſo ſtubborne, and none need bee neglected. Hitherto I haue digreſſed out of mine intended courſe, through the deſire I haue to aduance minerall workes. Now I will returne to ſhew the nature and qualities of theſe metals, as I haue done of other minerals.

Gold of all metals is the moſt ſolid, and therefore the moſt heauie, as hauing few impurities or heterogeneall ſubſtances mixed with it. And therefore it is not ſubiect to corruption, as other metals are, neither will it looſe any of his ſubſtance, either by fire or water, although it ſhould be held in them a long time: ſo as it is an idle and vaine perſwaſion that many haue, who *Baccius lib.6. cap.8.* thinke by boyling Gold in broth, to get ſome ſtrength from thence, and ſo to make the brothes more cordiall. The like I may ſay of putting Gold into Electuaries or Pils, vnleſſe it be in caſe of Quickſiluer taken into the body, which the Gold by touch may gather to it, otherwiſe it goes out of the body as it came in, without any concoction or alteration, or diminution. And if it bee diſſolued in ſtrong water, it will be reduced againe to his metallin ſubſtance, without diminution, much leſſe will it be diſſolued without corroſiue Spirits, to make *aurum* *Baſilica chimia Pag. 204.* *potabile*, as ſome doe vndertake. *Crollius* doth acknowledge, that there is but one *Menſtruum* in the world that may doe it, and that he knowes not. But if we had it diſſolued, we are yet vncertaine what the quality of it would be, or what vſe to make of it in Phyſicke; onely becauſe it looſeth none of his ſubſtance, we know it can doe no hurt, and therefore we vſe it for Cautoryes, and *De Thermis cap.8.* to quench it in Beere or Wine, &c. to warme it, or to giue it ſome aſtriction from the fire. *Fallopius* in theſe

In ingreſſu ad infermos, pap. 373.

regards diſclaymes it in all minerall waters, as hee doth all other metals: and will not beleeue that any metall doth impart any qualitie vnto water. *Claudius* holds otherwiſe, and ſo doth *Baccius*, *Sauonarola*, *Montagnana*, *Venuſtus*, *Solinander*, and almoſt all that haue written of Bathes. For if we ſhould exclude Metals, wee muſt likewiſe exclude Stones, and Bitumina and Sulphur, and almoſt all minerals, except concrete iuyces. For none of theſe, after they haue attayned to their full conſiſtence, will of themſelues diſſolue in water, without the helpe of ſome concrete iuyce, as a medium to vnite them with the water. But before they haue their full conſiſtence, whilſt they are in *Solutis principijs*, as Earth, Iuyce, or Vapour, they may be communicated with water. Gold is ſo ſparingly bred in the bowels of the earth, as in that reſpect it can hardly furniſh a perpetuall Spring with any quality from it; yet ſome Bathes are held to participate with Gold, as *Ficuncellenſes*, *Fabariæ*, *Piperina*, *de Grotta in Viterbio: Sancti Caßiani de Buxo*, &c.

Theod. Tabernimontanus. p. 2 cap. 49.

Siluer comes next in puritie to Gold, but is inferiour vnto it, as appeares by the diſſolution of it, and by the blew tincture which it yeelds, and by the fouling of the fingers, &c. For the qualities of it, there is not much diſcouered. But as all other things of price are ſuperſtitiouſly accounted cordiall, ſo is this, eſpecially in hot and moyſt diſtempers of the heart: for it is eſteemed to bee cold, and dry, and aſtringent, and yet emollient. Wee haue no Bathes which doe manifeſtly participate with it: perhaps, by reaſon, nature doth not produce it inſufficient quantitie to infect waters. *Iohn Bauhinus* thinkes there may be Siluer in the Bathes at Boll: becauſe hee ſaith there was a Pyritis or Marcheſit examined by Doctor *Cadner*, and out of fiftie pound weight of it, hee drew two drams of ſiluer: a very ſmall proportion to ground his opinion vpon.

Iron is the moſt impure of all metals, as wee haue it wrought, and will hardly melt as metals ſhould doe, but with additaments and fluſſes. Neither is it ſo malleable, and ductible as other metals are, by reaſon of his many impurities. Yet we ſee that at Damaſco they worke and refine it in ſuch ſort, as it will melt at a Lampe, and is ſo tough, as it will hardly breake. And this is not by reaſon of any eſpeciall Myne differing from other iron Mynes, for they haue no Mynes of iron neere to Damaſcus, as *Bellonius* reports, but haue it brought thither from diuers other places, onely their art in working and purifying it, is beyond ours. So the Spaniſh Steele and iron is purer then ours, and wee doe eſteeme of Bilbo-blades beyond others which are quenched in the Riuer Bilbilis: as *Turnus* his Sword in *Virgil* was quenched in the Riuer Styx.

Enſem quem Danno ignipotens Deus ipſe parenti
Fecerat, & Stygia candentem extinxerat unda.

Ænead 12.

But the hardning of Steele lyeth not in this point; other waters no doubt may ſerue as well. But I perſwade my ſelfe that our iron might be made much purer, and perhaps ſome gold extracted from it which it holds.

Concerning the temperature of Iron and Steele, *Galen* reckons it among earth, and therefore it muſt bee cold. *Minardus* is abſolutely of that opinion, and ſo are moſt of our Phyſitians. Onely *Fallopius* holds it to be hot, becauſe *Scribonius Largus* preſcribes it in vlcers of the bladder, which it doth cure, not in regard of heating, but drying; for it dryeth and bindeth much, and therefore by *Galens* rule it muſt be cold. *Aſtringentia omnia frigida.* I haue obſerued in Iron and

Simpl. lib.9.

Lib.16 Epiſt.5.

De metallis cap. 20.

Simpl. lib.4. c.7.

Steele two diſtinct qualities, The one opening, or deopilatiue; the other aſtringent. The opening quality lyeth in a volatill Salt or Niter, which it is full of, the aſtringent qualitie in the Crocus, or Terreſtriall part. Theſe two ſubſtances are thus diſcerned and ſeuered. Take of the fylings of Steele or Iron, and caſt it into the flame of a candle, and you ſhall ſee it to burne like Saltpeter or Roſin. Take theſe fylings, and infuſe them three or foure times in Water or Wine, as wee vſe to make our Chalibeat Wines, till the water or wine haue diſſolued all this ſalt, and then dry it and caſt it into the flame, and it ſhall not burne, but the liquor will haue a ſtrong taſte from this Salt. And this is it which opens obſtructions. The aſtringent qualitie lyeth in the Terreſtriall ſubſtance, as is euident, after either, by infuſions, or by calcination, the volutill ſalt is departed from it, that which remaines, is very aſtringent, and ſtayeth all manner of fluxes, &c.

Concerning Bathes participating with Iron, we haue too many examples of them for *Fallopius* to contradict. We may let him inioy his opinion of the *Calderiana, Veronenſia & Villenſia Lucenſia*, although it bee againſt the iudgement of all other who haue written of them, and it is hard for him to bee confident in a negatiue. Wee haue examples more then enough to proue the qualitie of Iron in our minerall waters. *Balneum Reginæ in agro Piſano*, is actually hot, and from iron. So is *Balneum Sancti Caſsiani in agro Senenſi*: So is *Balneum Ficuncellæ, de Ruſſellis, Bora in agro. Florent. Brandulæ in agro Regienſi, Viſicatoriæ in Tuſcia, Iſenbrun* by Leige, Forgenſe in Normandy: the Spa water, Tunbridge water: Briſtoll water by S. *Vincents* Rocke: all which, ſome being hot, and ſome cold, participate with Iron, as may be proued, not onely by the conſent of all

Solinander,
pag 193.
Venuſtus, pag.
159.
Baccius lib. 6.
cap. 3.
Sauonarola.
Renodæus pag.
305.

writers, which haue made mention of them, but by the Mynes from whence they come, or by their taſte, or by their vertues.

Copper comes neereſt to the nature of Iron, but is more pure, and more eaſie of fuſion, and will bee almoſt all conuerted into Vitrioll. They are conuertible the one into the other, as I haue ſhewed out of *Erker*, in Vitrioll. And by the practiſe at Commataw and Smolnicium. The like alſo hath beene ſhewed in Cornewall, at the Confluence by Maſter *Ruſſell*. *Ariſtotle* alſo tels of a Copper Myne in Thalia, an Iland of the Tyrrhen Sea, which being wrought out, turned to an iron Myne: in this ſimilitude of nature, we cannot but iudge that there is a ſimilitude in qualities, and that Iron being cold, Copper cannot be hot. Temperate it may be, becauſe leſſe aſtringent then Iron, and more cleanſing: *Rhaſis* ſaith that it purgeth like a Catharticum, & in his Continent, preſcribes it to purge water in dropſies. Another argument that all purgatiues are not hot; It dryeth exceedingly, and attenuates and digeſts. Wee haue diuers waters which participate with it, which if they be pure from Copper it ſelfe, are very ſafe and wholeſome: but if they be foule, and proceede from the excrements of Copper, they are not wholeſome to drinke. *Balnea Cellenſia ſeu ferina in Martiana Silua*, doe conſiſt of Copper and Allum. The Bath of Fabaria in Rhetia, of Copper and Gold. *Aqua de Grotta in agro Viterbienſi*, is full of Copper; ſo is *Aqua Iaſielli, Balneum Leucenſe in Valeſiis*: *Marcus Paulus Venetus*, tels of a greeniſh fountaine in Perſia, which purgeth exceedingly, and is held to come from Copper.

Libau. de nat. metall. c. 10.

Tinne and Lead are two of our Staple commodities which our Country yeelds plentifully, not onely for our owne vſe, but to ſupply other Nations. Tinne is bred in

Cornwall, and part of Deuonſhire, and in the Iſles of Silly, which from thence were called *Caßiterides*. It is melted out of little blacke ſtones, which the Dutch call *Zwitter*, with great charge, becauſe they cannot melt it, but with wood coales, which is brought them farre off, and they are faine to runne it ouer two or three times, before they can get out all the Tinne, and yet much of it is waſted in the blaſt. I doubt not but it might bee done with Sea-Coale, if they knew the Artifice, and with as great a product of Tinne. There is both ſiluer & gold found in it, but without waſting of the Tinne. We know no meanes to ſeuer it. It is in qualitie cold and dry, and yet moues ſweat abundantly, as I haue proued.

Lead is melted commonly out of an Oare common to Siluer and Lead, as *Pliny* ſaith, called *Galena*. And although *Agricola* ſaith of the villachar Lead, that it holds no Siluer, and therefore fitteſt for aſſayes; yet *Lazarus Ercker* contradicts it out of his owne experience. Our Countrie abounds with it euery where, eſpecially at the Peake in Darbiſhire, and at Mendip in Sommerſetſhire; Wales alſo and Cornwall, and Deuon, are full of it, and ſo is Yorkeſhire and Cumberland. The qualities of it are cold and dry. But for theſe two metals, we finde no waters which are infected with them. In Lorayne, they haue Bathes called *Plumbaria*, which ſome thinke by reaſon of the name, to proceede from Lead: but *Iohn Bauhinus* thinkes they ſhould bee called *plumiers*, as *Pictorius* writes it from the French word *plumer*, *à deplumando*, becauſe they are ſo hot, as they vſe to ſcald fowles in them, to take off their feathers.

Pag.901

Thus much for metals, and all other ſorts of Minerals, with their ſeuerall Natures and Bathes infected with any of them. As for mixed Bodies, and flores, and recrements, &c. they are to be referred to the ſimple bodies

dies from whence they proceede: As *Tutia, Pompholix: Minium, Ceruſſa, Sublimatum, Præcipitatum, &c.*

Cap. II.

Of the generation of metals in the earth. Their ſeminary ſpirit. That it is not from the Elements:

NOw I muſt ſhew the generation of theſe minerals in the bowels of the earth, which of neceſſity wee muſt vnderſtand, before wee can ſhew the reaſons how minerall waters receiue either their actuall heat, or their vertues.

Fallop. de metallis cap. 11.
Libauius de nat: metal. cap. 12:

Some haue imagined that metals and minerals were created perfect at the firſt, ſeeing there appeares not any ſeede of them manifeſtly, as doth of Animals and Vegetables; and ſeeing their ſubſtances are not ſo fluxible, but more firme and permanent. But as they are ſubiect to corruption in time, by reaſon of many impurities, and differing parts in them, ſo they had need to be repaired by generation.

It appeares in *Geneſis*, that Plants were not created perfect at firſt, but onely in their Seminaries: for *Moſes*, Cap. 2. giues a reaſon why Plants were not come forth of the earth, *ſcil.* becauſe (as *Tremelius* tranſlates it) there had as yet neither any raine fallen, nor any dew aſcended from the earth, whereby they might bee produced and nouriſhed: The like we may iudge of minerals, that they were not at firſt created perfect, but diſpoſed of in ſuch ſort, as they ſhould perpetuate themſelues in their ſeuerall kindes. Wherefore it hath euer beene a receiued *Axiome*, among the beſt Philoſophers, that minerals are generated, and experience hath confirmed it in all kindes. Our Salt-peter men finde that

Agricola de ortu & cauſis Subt. lib. 5. c. 1.

when they haue extracted Salt-peter out of a floore of earth one yeare, within three or foure yeares after, they finde more Salt-peter generated there, and doe worke it ouer againe. The like is obſerued in Allum and Copperaſſe.

As for metals, our Tinners in Cornewall haue experience of Pits which haue beene filled vp with earth after they haue wrought out all the Tinne they could finde in them; and within thirty yeares they haue opened them againe, and found more Tinne generated. The like hath beene obſerued in Iron, as *Gaudentius Merula* reports of *Ilua*, an Iland in the Adriaticke Sea, vnder the Venetians, where the Iron breedes continually as faſt as they can worke it, which is confirmed alſo by *Agricola* and *Baccius*: and by *Virgil*, who ſaith of it, *Ilua inexhauſtis Chalybum generoſa metallis*. The like we reade of at Saga *in Lygijs*, where they dig ouer their Iron Mynes euery tenth yeare. *Iohn Matheſius* giues vs examples, almoſt of all ſorts of minerals and metals, which he hath obſerued to grow and regenerate. The like examples you may finde in *Leonardus Thurneiſerus*. *Eraſtus* affirmes that hee did ſee in *S. Ioachims* dale, ſiluer growne vpon a beame of wood, which was placed in the pit to ſupport the workes: and when it was rotten, the workemen comming to ſet new timber in the place, found the ſiluer ſticking to the old beame. Alſo he reports that in Germany, there hath beene vnripe and vnconcocted ſiluer found in Mynes, which the beſt workemen affirmed, would become perfect ſiluer in thirty yeares. The like *Modeſtinus Fachius*, and *Matheſius* affirme of vnripe and liquid ſiluer; which when the workemen finde, they vſe to ſay, *We are come too ſoone.* But I need not produce any more proofes for this purpoſe, as I could out of *Agricola* and *Libauius*, and others,

Lib.3.c.19.

In Sarept.conci. 3.11.&c.

In Alchimia magna.

De metallis pag. 17.& 19.

Von probierung der ertze.
In Sarepta.

ſeeing our beſt Philoſophers, both ancient and moderne, doe acknowledge that all minerals are generated. The manner of generation of minerals and metals, is the ſame in all, as is agreed vpon both by *Plato* and *Ariſtotle*, and *Theophraſtus*.

Sebaſt. Foxius l. 3. c. 6.
Seuerinus c. 8. p. 125.

And as the manner of generation of minerals is alike in all, ſo it differs from the generation of animate bodies, whether animals or vegetables, in this, that hauing no ſeede, they haue no power or inſtinct of producing other indiuiduals, but haue their ſpecies perpetuated *per virtutem ſeu ſpiritum ſemini analogum*, by a ſpirituall ſubſtance proportionable to ſeede, which is not reſident in euery indiuiduall, as it is in animals and Plants, which *Moſes* ſaith haue their ſeeds in themſelues, but in their proper wombes. This is the iudgement of *Petrus Seuerinus*, howſoeuer he doth obſcure it by his Platonicall grandiloquence. And as there is not *Vacuum in Corporibus*, ſo much leſſe in *Speciebus*. For that the Species are perpetuated by new generations, is moſt certaine, and proued before: that it is not out of the ſeeds of indiuiduals, is euident by this, that if minerals doe not aſſimulate nouriſhment by attraction, retention, concoction, expulſion, &c. for the maintenance of their owne indiuiduall bodies, much leſſe are they able to breede a ſuperfluitie of nouriſhment for ſeede. And how can they attract and concoct nouriſhment, and expell excrements, which haue no veines nor fibres, nor any diſtinct parts to performe theſe Offices withall? Moreouer they are not increaſed as Plants are, by nouriſhment, whereas the parts already generated, are extended in all proportions by the ingreſſion of nutriment, which fils and enlarges them: but onely are augmented externally vpon the ſuperficies, by ſuperaddition of new matter concocted by the ſame vertue & ſpirit, into the ſame Species.

Cæſalpinus de metal. lib. 1. c. 2.

Capi 2.

Eraſt. diſput. part 2. p. 262.

Thus much for the manner of all minerall generations, which is not much controuerted: the chiefe difference is about the efficient and the matter. About the efficient cauſe of generations (for wee muſt handle them all together) there are diuers opinions, as there are diuers cauſes which concurre to all generations of animals, vegetables, or minerals. But there muſt be one principall efficient cauſe, to giue the forme to all Species, as there are other adiuuant and attending cauſes. The principall cauſe and agent in this worke, is by moſt attributed to the influence of the Planets, eſpecially to the Sunne, who either by his light, or by his heat doth frame the ſpecies of all things, and ſo of minerals, but chiefely in regard of his heat. This heat working vpon apt matter, is thought to produce the ſeuerall ſpecies which wee ſee. As for the motion of the Planets, it is certaine that they moue continually in a conſtant order, and the world could not ſubſiſt as it doth without it: ſo as it may bee *cauſa ſine qua non:* a very remote cauſe, as there may be a hundred moe cauſes of that nature. So likewiſe the light, which the Peripatetickes make the inſtrument of cœleſtiall effects, can doe as little to the furtherance of generations, ſeeing they proceed as well by night as by day: and for minerals, it is perpetuall night with them, the denſity of the earth and rocks not ſuffering the light to paſſe. Wherefore they inſiſt chiefely vpon the heat of the Sunne. But *Moſes* tels vs that Plants were created with their ſeedes in themſelues vpon the third day, before the Planets, which were not created till the fourth day; to ſhew vs that Plants and terreſtiall ſubſtances depend not vpon Planets for their generations, nor for their vertues, but haue the principall cauſes of them in themſelues. The ſame wee may iudge of minerals, being terreſtriall ſubſtances, and propagated by

Dorn.phiſica Geneſis.

ſeeds, as Plants are, and likely to bee created vpon the ſame day with Plants, ſeeing there is no other mention of their creation in *Moſes*.

Now for the heat of the Sunne, no doubt it is an vniuerſall foſterer of all inferiour ſubſtances: but that it ſhould beget particular Species, is very improbable. The heat of the Sunne is no more apt to breed a Nettle, then a Dock, Brimſtone then Salt, &c. For it cannot giue the eſſence to any thing: heat being onely a quality which can breed no ſubſtance, and ſuch a quality as can onely ſegregate heterogeneall ſubſtances, and thereby congregate homogeneall. Whereas in all generations there muſt be a further power and vertue, to proportion the Elements fit for euery Species (if they will haue all things made of the Elements) and to bring the Species from a potentiall being to an actuall, giuing to euery thing his proper ſhape, quantity, colour, ſmell, taſte, &c. and to vnite them, which before were of different natures. It muſt bee an internall and domeſticall *Gal. de Mareſ.* agent, and efficient cauſe, which muſt performe this: and ſuch a one as is not common to all Species alike, but proper to that which it produceth: otherwiſe there would be no diſtinction of Species. And therefore *Moſes* ſaith of Plants, that they haue their ſeeds in themſelues, according to their ſeuerall kindes. Neither can any externall cauſe giue an eſſentiall forme to any thing, which forme muſt bee αὐτόφυη, inbred in the thing it ſelfe, and not aduentitious. And therefore *Scaliger* ſaith, *Formæ, non ſolis eſt quantitatis terminare*, and *Ariſtotle, calore natura vtitur tanquam miniſtro aut inſtrumento, non tanquam opifice aut legiſlatore.* Wherefore we will grant the Sunne to be an adiuuant cauſe, and by his heat to foſter and cheriſh inferiour generations: but not to be a principall and begetting cauſe. And ſo *Zabarella* doth *De calore.*

mollifie the harſhneſſe of the former opinion: and doth acknowledge that the Sunne doth further generations onely as an inſtrument of another ſuperiour power, whereby in minerals it may make the matter more apt to receiue the forme, but it makes no minerals, no more then it makes bloud in our bodies.

Others make the elements to be the principall cauſes of all ſpecies by their qualities. For the matter of the Elements, being a paſſiue matter, cannot bee an efficient cauſe of generations. Theſe qualities muſt bee heat or cold: for the other two are paſſiue, and attend rather vpon the matter of generations, then vpon the efficient. Fire therefore by his heat is thought of all the Elements to haue the greateſt hand in all generations, being moſt actiue and ſuperiour to all the reſt. This is he that muſt aſſemble the reſt of the Elements together, for the generation of euery Species, and ranke them in due order, proportion, weight, meaſure, &c. This is he that muſt reconcile the differences which are in their natures, and bring them to vnion. This muſt attract nouriſhment, and preſcribe the quantities, dimenſions, parts, figures, colours, taſts, ſauours, &c. of euery thing. A large Prouince he hath to gouerne, with one naked and ſimple quality, which can haue but one ſimple motion. *Simplicibus corporibus ſimplices tantùm motus congruunt.* Heat can but heat, and the effects of this heat are by ſeparation of different ſubſtances, τῶν ἀλοφύλων to congregate thoſe that are alike, τὰ ὁμόφυλα : But in this worke we make heat to vnite differing ſubſtances: for all generation is of differing ſubſtances vnited into one. Againe, fire hauing but one quality to worke withall, whereby he muſt vnite the other three Elements, what ſhall bring and vnite fire vnto them? This muſt be another power ſuperiour to them all, for wee muſt not imagine that they meete by chance as trauellers doe. 1 *De anima* And therefore *Ariſtotle* explodes this efficient of fire, *Item 2. cap. 4.* and attributes it to the formes of naturall things.

As for cold in the other elements, it is farre more vnlikely then heat, to performe theſe offices, being rather a diſtractiue, then a generatiue quality, and is not called in by any Author to this work, before the Species haue receiued his forme by heat: and then it is admitted only for conſolidation, but how iuſtly, it is doubtfull: for heat doth conſolidate as well as cold, by drying vp moyſture. But we will not grant this to either of them, as principall Agents, but as they are inſtruments attending the formes of naturall things.

The Alchymiſts make Sulphur to bee the principall efficient of all minerals, eſpecially of metals, and Mercury the matter. If they meane common Sulphur and Mercury, which are perfect Species in their kindes, they are much deceiued, and this opinion is ſufficiently confuted by all that oppugne them. But it ſeemes they vnderſtand ſome parts in the ſeminary of metals which haue ſome analogye with theſe: and ſo their opinion may be allowed. For the ſpirit, which is the efficient in theſe generations, doth reſide in a materiall ſubſtance, which may be reſembled to Sulphur or Oyle, as ſome other part may be reſembled to Mercury. For all generations are framed of different parts vnited by this Spirit. Thus much of the different opinions concerning the efficient of all generations, and in particular of minerals. The matter whereof minerals are bred, is attributed chiefely to the Elements, as the generall matter of all animate and inanimate bodies: inſomuch as both the heauens, and the very ſoules of men are made to proceed from the Elements.

Concerning the heauens, it hath beene the ancient opinion of the Platonicks, Pythagoreans, and Epicuræans, that not onely theſe inferiour bodies, but alſo the cœleſtiall, haue beene framed out of the Elements. *Plato* ſpeaking of the heauens, ſaith, *Diuini decoris ratio poſtulabat talem fieri mundum, qui & viſum pateretur & tactum. Sine igne videri nil poteſt, ſine ſolido nil tangi : ſolidum ſine terra nihil.* Wherefore holding the heauens to be viſible and ſolid, they muſt bee made of the Elements. The Pythagoreans, and the Brachmanni of India held the ſame opinion of the heauens : where *Apollonius Tianæus* was inſtructed in all the Pythagorean doctrine, as *Philoſtratus* reports. The Epicureans alſo were of the ſame opinion, as appeares in *Virgil*, where he brings in *Silenus*, one of that ſect, and one of *Bacchus* his crew, ſinging in this manner.

Triſmigiſtus in Aſclepio cap. 1.
Plato.
In Timeo in Dialogo de natura.
In vita Apolloni.
Egloga 6.

Namque canebat, vti magnum per inane coacta
Semina, terrarumque, animaque mariſque fuiſſent,
Et liquidi ſimul ignis: vt his exordia primis
Omnia, & ipſe tener mundi concreverit orbis.

Silenus ſung, how through the Chaos vaſt,
The ſeeds were ſet of Earth, of Ayre, of Seas,
Of pureſt fire: how out of theſe at laſt,
All things haue ſprung, and alſo out of theſe
The infant world was moulded.

Of this opinion alſo was *Lucretius*, *Philo Iudæus*, *Valeſius*, *&c.* although *Valeſius* doth make more pure Elements for the heauens then ours are. *Ariſtotle* forſooke his Maſter *Plato* in this point, and frames the heauens of a quinteſſentiall ſubſtance.

De ſacra Philoſoph. cap. 51.

But howſoeuer the heauens may participate with elementary qualities, and bee ſubiect to generation and corruption in their parts: yet mee thinkes they ſhould exempt our ſoules from this originall, and not make them out of the fragments of the Elements.

Scaliger inueighs againſt *Alexander Aphrodienſis*, for this opinion, and ſaith that hee hath poyſoned our philoſophy herein: *Venenauit hanc philoſophia partem.* So both he and others deriue the ſenſe, motion, vnderſtanding, growth, and the naturall faculties of our ſoules, and the peculiar properties of euery thing, vnto this originall, *turpiſſimo errore*, as *Seuerinus* ſaith. And *Scaliger* in another place concerning this: *De intellectu & ratione ipſaque anima qua contaminarint iſta nebula Aphrodiſienſes, & pudet dicere & piget meminiſſe.* I am aſhamed to ſpeake, and grieued to thinke how this *Aphrodiſienſis* hath polluted our reaſon and vnderſtanding, and our very ſoules with his foggy doctrine, in aſcribing all theſe vnto the Elements. By the ſame reaſon they may aſcribe the barking of Dogges, the ſinging of Birds, the laughing and ſpeech of men, to the Elements. Their opinion is more probable, which hold, *animam ex traduce*, and to bee communicated as one light to another: as *Timoth. Bright* proues in *Phiſicam Scribonij*, and not to aſcribe it to the Elements, nor to miracles, or new creations. But there is farre more reaſon to deriue from the Elements, the taſtes, colours, ſmels, figures, numbers, quantities, orders, dimenſions, &c. which appeare more in corporall ſubſtances, and yet theſe are not from the Elements. For how can they giue theſe affections to other things, when they haue them not themſelues? *Si non eſt ab elementis guſtare, quare ſit guſtari?* What taſt haue any of the Elements? Fire or heat which is the moſt actiue Element, hath none. And whereas it is thought, that bitterneſſe proceeds from heat, wee finde that many ſharpe and tart fruits, being alſo very bitter before they are ripe, (as

Cap. de mixtione

Oliues for example) yet let them hang vpon the tree till they bee ripe, and they loſe their bitterneſſe, and alſo their ſharpeneſſe, by reaſon of their better concoction by heat. The like difference wee finde betweene our *oleum omphacinum*, and the ripe oyle. So likewiſe *opium*, which is held to be very cold, yet it is extreame bitter, ſo as the cold parts in it are not able to maſter the bitterneſſe, but this is ſtill predominant: wherefore heat can be no cauſe of bitterneſſe, vnleſſe it bee in exceſſe or defect, as *Scaliger* confeſſeth. Wormewood is very bitter, being hot and dry in the ſecond or third degree: if heat were the cauſe of it, then all other ſimples which are hot and dry in the ſame degree, ſhould be alſo bitter. As I haue ſaid of taſts, ſo I may ſay of all the other affections of naturall things, that they proceed not from the Elements, but from the ſeeds and formes of euery thing. So for fat and vnctuous ſubſtances, as Sulphur, Bitumen, Oyle, Greaſe, &c. vnto what Element ſhall we aſcribe them? Not vnto fire, becauſe this is extreme hot and dry, that is temperate in heat, and very moyſt. Moreouer, fire would rather conſume it, then generate it: and Phyſitians iudge the generation of fat in our bodies to proceed rather from cold, then from heat. Ayre, if it haue any ingenerate quality, as ſome doe make doubt out of *Ariſtotle*, it is cold and moyſt, as I haue ſhewed before, *cap.* 2. *&* 5. and therefore as it cannot agree with fire, nor be a fewell to it, ſo it cannot be any materiall cauſe of fat, or oylie ſubſtance: being more agreable to water, from whence it is thought to be made by rarefaction, and into which it is thought to be reduced by condenſation. Wherefore being of a watry nature, it cannot agree with oyle or fatneſſe, nor bee the matter of it. The like wee may iudge of water, which will not vnite with oyle, which doth terminate both

1 Meteorol. 4. Item de mundo vbi dicit aërem comparatum eſſe ad aliam & alium naturam induendam.

water and ayre, and therefore muſt be oppoſite to them both. As for earth, being cold and dry, and ſolid, it cannot be the matter of this which is temperate, and moyſt, and liquid. Neither can all the Elements together make this ſubſtance, ſeeing there is no vnctuouſneſſe in any of them, and they can giue no more then they haue. So as I cannot ſee how this oylie ſubſtance, which is very common in all naturall things, and wherein the chiefe faculties of euery thing doth reſide, as their *humidum radicale*, ſhould be from the Elements.

So likewiſe for the ſubſtance wherewith euery thing is nouriſhed and increaſed, and into which euery thing is reſolued, it appeares not how it ſhould bee from the Elements. *Hippocrates*, of whom *Macrobius* ſaith, *nec fallere nec falli potuit*, hath two notable axioms for the clearing of this poynt. The one is *Vnumquodque in id diſſoluitur vnde compactum eſt*. Euery thing is diſſolued into that whereof it was made. The other, *Iiſdem nutrimur ex quibus conſtamus*, wee are nouriſhed by ſuch things as we conſiſt of. *Ariſtotle* alſo hath the ſame. If this axiome be true, as I hold it to be, and I know none that contradict it, then we muſt conſiſt of ſuch things as we are nouriſhed withall. But we are not nouriſhed by the Elements, and therefore wee conſiſt not of them. Fire nouriſheth nothing, water nouriſheth not, as Phyſitians confeſſe: Ayre is too thin a ſubſtance, and Earth too thicke. And as they doe not nouriſh them when they are ſingle, ſo being compounded, they can doe as little. *Ariſtotle* ſaith that ſome Plants are nouriſhed with water alone, ſome with earth alone, and ſome with both together. But if earth and water be mixed for our nouriſhment, they making but mud, would make vs haue muddy braines. We will grant the Elements to be *matrices rerum naturalium*, the wombes and nurſes of naturall

In ſom. Scipionis cap. 6.

De nat. *hominis*

2 *De gen. cap. 8. Item lib. de ſenſu & ſenſibile.*

3 *De gen. animal. cap. vltimo.*

naturall things, but we will not grant them to be materiall cauſes. Neither can we attribute more dignity vnto them, then we doe our Mothers, who depart not from their ſubſtance whereof they conſiſt, as fleſh, bones, ſinewes, veynes, arteries, &c. to the nouriſhment of their Infants, but onely prepare bloud for them, from the nutriments which they receiue. And all the Elements in the world cannot make this bloud, neither as the matter, nor as the efficient. But as the Mother is furniſhed with bloud to nouriſh the Infant, and with conuenient heat to foſter it withall, ſo are the Elements ſtored with all manner of matter fit for all generations: ſo as the ſeeds or formes of naturall things, will neuer want matter to nouriſh them, nor will euer want formes. So that it is manifeſt that if naturall bodies be not nouriſhed by the Elements, they are not compounded of them: but being nouriſhed by other ſubſtances then the Elements, they muſt be compounded of the like; *Simile ſimili nutritur: compoſita compoſitis conſtant & nutriuntur.*

Thus much for the Geneſis or generation and natation of naturall things, that thereby we cannot gather that they are either made or nouriſhed by the Elements. Now let vs examine whether by the Analyſis or diſſolution of them, we may finde the foure Elements, according to the former axiome, that euery thing is diſſolued into that whereof it was made, and is made of that whereinto it is diſſolued, as *Ariſtotle*, *Hippocrates*, and *Galen* doe affirme. So that if the Elements enter into the compoſition of naturall things, eſpecially as the principall materials whereof they conſiſt, they muſt needs appeare in the diſſolution of them. This diſſolution is either naturall or artificiall. In the naturall diſſolution of all things, *Hippocrates* obſerues three diſtinct ſubſtances, *calidum, humidum ſiue fluidum, & ſiccum* *ſiue ſolidum*, according to the three Elements or principles whereof he ſaith they are framed. His inſtance is principally man, but he affirmes it to hold in other animate inanimate bodies. Theſe Elements he termeth *continentia contenta & impetum facientia*, as *Galen* expounds it. Thoſe which he cals *continentia*, are bones, nerues, veynes, arteryes, and from thence, muſcles, &c. *Contenta* are *humida*, or *humores*, bloud, flegme, choler, melancholy, which after death, are cold, and congeale, being heated as *Galen* ſaith, from the heart, in liuing bodies: *Impetum facientia*, are ſpirits animall, vitall and naturall.

Iſagoge cap. 8. 1 de Elementis cap. 15.

Theſe three Elements, *Galen* acknowledgeth to bee the neereſt, but the other which are more remote, to be moſt vniuerſall. But *Hippocrates* ſaith that heat and cold, &c. are very powerleſſe Elements, and that ſharp, bitter, ſweet, &c. are more powerfull, τὴν μεγάλην δύναμιν ἔχοντα. So that theſe are the three Elements whereof all things doe conſiſt, and into which they are naturally reſolued. and theſe doe ſeeme to reſemble the foure Elements, but are not the ſame. For heat may reſemble fire, although this heat be procured by motion in euery thing whileſt it liueth, and not extrinſecally. Moyſture may reſemble water and ayre. Dryneſſe may reſemble earth, cold appeares in them all after that the heat or ſpirit is departed.

De veteri medicina.

In the artificiall Analyſis of naturall bodies, the Alchymiſts tels vs that they finde three Elements, and no more, whereof euery thing doth conſiſt, and whereinto it is reſolued: namely, *Vaporoſum, inflammabile, fixum:* which they call Mercury, Sulphur, and Salt, and they ſeeme to agree with *Hippocrates*. For their Mercury may well reſemble *Hippocrates* his ſpirits, or *impetum facientia*: Sulphur his humors or *fluidum* or *contenta:* and

Salt, his *ſiccum* or *denſum*, or *continentia*. Theſe they ſay are found in euery thing, animal, vegetable, or minerall, and no other. And as for the foure common Elements, ſeeing they are diſtinct in place and ſcituation, and therefore cannot concurre and meet to the generation of euery animal, Plant and Minerall, &c. but by violence, the earth being ſometimes carried vpwards, and the fire downewards, contrary to their naturall motions: and this, not once for all, but daily and hourely: it is not likely that theſe ſubſtances can bee bred of the Elements, or be maintained in a perpetuall ſucceſſion by a violent cauſe. And therefore it is no maruell if theſe Elements be not found in the diſſolution of naturall bodyes. Thus much in generall concerning all generations, that hereby we may the better iudge of the particular generations of minerals, which differ not from the reſt, but onely in this, that their ſeeds are not in euery indiuiduall, as the others are, but are contained *in matricibus*, in their wombes, and there they are furniſhed with matter to produce their Species: not out of the Elements, no otherwiſe then *ex matricibus*, as the childe in the mothers wombe, but haue their matter and nouriſhment from the ſeeds of things, which are agreeable to their ſpecies: which ſeeds wanting meanes to produce their owne ſpecies, doe ſerue others, and yeeld matter and ſubſtance vnto them.

Now let vs come more particularly to the generation of minerals, wherein we will firſt examine *Ariſtotles* opinion, as moſt generally receiued, then I will preſume to ſet downe mine owne.

CAP. 12.

The generation of minerals examined, the Authors opinion herein.

A*Riſtotle* makes the humidity of water, and the dryneſſe of earth, to be the matter of all minerals: [b]the dryneſſe of earth to participate with fire, and the humidity of water with ayre, as *Zabarella* interprets it; ſo that to make a perfect mixt body, the foure Elements doe concurre: and to make the mixture more perfect, theſe muſt be reſolued into vapour or exhalation by the heat of fire, or influence from the Sunne and other Planets, as the efficient cauſe of their generation: but the cauſe of their congelation to be cold in ſuch bodies as heat will reſolue. This vapour conſiſting partly of moyſture, and partly of dryneſſe, if all the moyſture bee ſpent, turnes to earth or ſalt, or concrete iuyces, which diſſolue in moyſture: if ſome moyſture remaine before congelation, then it turnes to ſtone: if this dry exhalation be vnctuous, and fat, and combuſtible, then Bitumen and Sulphur, and Orpiment, are bred of it: if it be dry and incombuſtible, then concrete iuyces, &c. But if moyſture doe abound in this vapour, then metals are generated which are fuſible and malleable. And for the perfecting of theſe generations, this exhalation is not ſufficient, but to giue them their due conſiſtence, there muſt be the helpe of cold from Rockes in the earth to congeale this exhalation. So that here muſt be two efficients, heat and cold. And for the better effecting of this, theſe exhalations doe inſinuate themſelues into ſtones, in the forme of dew or froſt, that is, in little graines; but differing from dew and froſt in this, that theſe are generated after that the vapour is conuerted to

Eraſtus, Careriſus, Cæſalpinus, Martinus, Moriſinus, Foxius, Magyrus, Libavius.

3 Meteor. c ult. Cæſalp. l 3. c. 1.

water; whereas Minerals are generated before this conuerſion into water. But there is doubt to bee made of froſt, becauſe that is bred before the conuerſion of the exhalation into water, as may appeare, *Meteor*. 1. According to this aſſertion there muſt be two places for the generation of minerals: the one a *matrix*, where they receiue their eſſence by heat in forme of an exhalation, and from thence they are ſent to a ſecond place to receiue their congelation by the coldneſſe of Rockes: and from this *matrix* come our minerall waters, and not from the place of congelation.

Libav. de nat. metall. c.14.
Carerius 178

Septal. in Hipp. de aere, aqu. &c.

This is the generation of minerals, according to *Ariſtotle*; but it is not ſo cleare, but that it leaues many ſcruples, both concerning the matter, and the efficients. For the matter, it ſeemes not probable, that water and earth ſhould make any thing but mudde and dirt; for you can expect no more from any thing then is in it, the one is cold and dry, the other cold and moyſt; and therefore as fit to be the matter of any other thing, as of particular minerals. And water, whereof principally metals are made to conſiſt, is very vnfit to make a malleable and extentible ſubſtance, eſpecially being congealed by cold, as wee may ſee in yce. But ſome doe adde a minerall quality to theſe materials, and that ſimple water is not the chiefe matter of metals, but ſuch as hath imbibed ſome minerall quality, and ſo is altered from the nature of pure water. This aſſertion doth preſuppoſe minerals in the earth before they were bred: otherwiſe what ſhould breed them at the firſt, when there was no minerall quality to be imparted to water? Againe, this minerall quality either giues the water or the vapour of it the eſſence of the minerall, and then it is not the effect of water, but of the minerall quality, or the potentiall faculty to breed it. If the eſſence, then this metallin water, or vapour, muſt haue the forme of the metall, and ſo be fuſible and malleable. If it haue onely the power and potentiall faculty, then the generation is not perfected, but muſt expect further concoction. This concoction is ſaid to be partly by heat, and partly by cold; if by heat, it muſt be in the paſſages of the exhalation as it is carried in the bowels of the earth: for, afterwards, when the exhalation is ſetled in the ſtones, the heat is gone. Now if the concoction bee perfected before the exhalation be inſinuated into the Stones, as it muſt be, if it be like dew, then is it perfect metall, and neither is able to penetrate the Stones, nor hath any need of the cold of them to perfect the generation. If by cold, it is ſtrange that cold ſhould be made the principall agent in the generation of metals, which generates nothing; neither can heate be the efficient of theſe generations. Simple qualities can haue but ſimple effects, as heate can but make hot, cold can but coole, &c. But they ſay cold doth congeale metals, becauſe heate doth diſſolue them; I anſwer, that the rule is true, if it bee rightly applied: as wee ſee yce which is congealed by cold, is readily diſſolued by heate. But the fuſion of metals cannot properly bee called a diſſolution by heate, becauſe it is neither reduced to water or vapour, as it was before the congelation by cold, nor is it permanent in that kinde of diſſolution, although after fuſion it ſhould be kept in a greater heat then the cold could be which congealed it. For the cold in the bowels of the earth cannot be ſo great, as it is vpon the ſuperficies of the earth, ſeeing it was neuer obſerued that there was any yce bred there. Alſo this diſſolution which is by fuſion, tends not to the deſtruction of the metall (but doth rather make it more perfect) as it ſhould doe according to the former rule rightly applied. And therefore this

Valeſius ſacra Philoſoph. c 49.

this diſſolution by fuſion, doth not argue a congelation by cold: which being in the paſſiue elements, doth rather attend the matter, then the efficient of generations: for it is apt to dull and hebetat all faculties and motions in nature, and ſo to hinder generations, rather then to further any. It is heate and moyſture that further generations, as *Ouid* ſaith, *Quippe vbi temperiem ſumpſere humorque calorque, Concipiunt.*

And thus much for *Ariſtotles* generation of minerals, where his vapours or exhalations doe rather ſerue for the collection or congregation of matter in the Mynes, then for the generation of them, as *Libauius* doth rightly iudge. *Agricola* makes the matter of minerals to be *Succus Lapideſcens Metallificus, &c.* and with more reaſon, becauſe they are found liquid in the earth; *Gilgill* would haue it Aſhes; *Democritus* Lyme: but theſe two being artificiall matters, are no where found in the earth. The Alchymiſts make Sulphur and Mercurie the matter of metals: *Libauius*, Sulphur and Vitrioll. But I will not ſtand vpon diſcourſing of theſe materials, becauſe it makes little to my purpoſe. It is enough for my purpoſe to ſhew the manner of theſe generations, which I take to be this.

Singularium lib. 1. part. 1.

De nat. metal. cap. 10.

There is a Seminarie Spirit of all minerals in the bowels of the earth, which meeting with conuenient matter, and adiuuant cauſes, is not idle, but doth proceed to produce minerals, according to the nature of it, and the matter which it meetes withall: which matter it workes vpon like a ferment, and by his motion procures an actuall heate, as an inſtrument to further his worke; which actuall heate is increaſed by the fermentation of the matter. The like wee ſee in making of Malt, where the graynes of Barley being moyſtened with water, the generatiue Spirit in them, is dilated, and put in action;

and the ſuperfluity of water being remoued, which might choake it, and the Barly laid vp in heapes ; the Seeds gather heat, which is increaſed by the contiguity of many graines lying one vpon another. In this worke natures intent is to produce mo[illegible] indiuiduals, according to the nature of the Seede, and therefore it ſhoots forth in ſpyres : but the Artiſt abuſes the intention of nature, and conuerts it to his end, that is, to increaſe the ſpirits of his Malt. The like we find in minerall ſubſtances, where this ſpirit or ferment is reſident, as in Allum and Copperas mynes, which being broken, expoſed, and moyſtened, will gather an actuall heat, and produce much more of thoſe minerals, then elſe the myne would yeeld ; as *Agricola* and *Thurneiſer* doe affirme, and is proued by common experience. The like is generally obſerued in Mynes, as *Agricola*, *Eraſtus*, *Libavius*, *&c.* doe auouch out of the daily experience of minerall men, who affirme, that in many places, they finde their Mynes ſo hot, as they can hardly touch them : although it is likely that where they worke for perfect Minerals, the heat which was in fermentation, whilſt they were yet breeding, is now much abated: the Minerals being now growne to their perfection. And for this heate wee neede not call for the helpe of the Sunne, which a little cloud will take away from vs, much more the body of the earth, and rocks ; nor for ſubterraneall fire : this inbred heat is ſufficient, as may appeare alſo by the Mynes of Tinglaſſe, which being digged, and laid in the moyſt ayre, will become very hot. So Antimony and Sublimat being mixed together, will grow ſo hot as they are not to be touched: If this be ſo in little quantities, it is likely to bee much more in great quantities and huge rocks. Heate of it ſelfe differs not in kinde, but only in degree, and therefore is

Carerius p. 212,

inclined no more to one Species, then to another, but as it doth attend and ſerue a more worthy and ſuperiour power, ſuch as this generatiue ſpirit is. And this ſpirit doth conuert any apt matter it meets withall to his owne ſpecies by the helpe of heate ; and the earth is full of ſuch matter which attends vpon the ſpecies of things: and oftentimes for want of fit opportunity and adiuvant cauſes, lies idle, without producing any ſpecies: but is apt to be tranſmuted by any mechanicall and generatiue ſpirit into them. And this matter is not the Elements themſelues, but ſubterraneall ſeedes placed in the Elements, which not being able to liue to themſelues, do liue to others. *Sic Roma creſcit Albæ ruinis*; the death of one is the life of another. From this confluence of ſeeds ariſe all the varieties and differences, and alterations which are obſerued in the generation or nutrition of naturall things: as in their colours, taſts, numbers, proportions, diſtempers, &c. Alſo from hence proceed the Tranſplantations which we finde in animals, vegetables, and minerals. In animals theſe Tranſplantations are not very frequent ; yet all our monſters may bee referred hereunto, as alſo the iſſue which comes from Dogges and Woolues, Horſes and Aſſes, Partriges and Hens, &c. Some doe thinke that the deſtruction of ſexes is a Tranſplantation, and that all ſeeds in themſelues are hermophroditicall, and neither maſculine nor feminine, but as they meet with ſtrong or weake impreſſions from ſupervenient cauſes; From hence come our *Androgyni*, or maſculine women, ſuch as *Horace* ſpeaks of, *Sabellis doctæ ligonibus verſare glebas*. Among thoſe animals which wee call *Inſecta*, theſe tranſplantations are more frequent, becauſe their ſeeds are more equiuocall, and eaſily tranſmuted from one ſpecies to another : as wee may ſee in

Muffetus in dialogo apologetico.

Wormes and Flies, and moſt euidently in Silkworms called *Cavallieri*.

In vegetables theſe tranſplantations are very frequent when one ſpecies is grafted vpon another, as *Virgil* ſaith,

> *Et ſteriles platani malos geſſere valentes*
> *Caſtaneæ fagos: ornuſq; incanuit albo*
> *Flore pyri, glandemq; ſues fregere ſub ulmis.*

Georg. 2.

Thus by commixtion of ſeuerall ſpecies, the firſt ſeeds doe oftentimes bring forth other fruits then their owne.

> *Mirantur q; novas frondes & non ſua poma.*

But all, as *Hippocrates* ſaith, by Diuine neceſſity, both that which they would, and that which they would not. So likewiſe Wheat is changed into *Lolium*, Baſil into Thyme, Muſterwort into Angelica, &c.

De Diæta 1.

In Minerals we find the like tranſplantations: as Salt into Niter, Copperaſſe into Allum, Lead into Tinne, Iron into Copper, Copper into Iron, &c. And this is the tranſplantation whereupon the Alchymiſts ground their Philoſophers ſtone.

This Seminary ſpirit is acknowledged by *Ariſtotle*: *Continent* (*inquit*) *ſemen in ſe cujuſq; fæcunditatis ſuæ cauſam*: and by moſt of his Interpreters: and *Moriſinus* cals it *Elpheſteria*, not knowing how to attribute theſe generations to the Elements. And this is the cauſe why ſome places yeeld ſome one vegetable or minerall ſpecies aboue another. *Quippe ſolo natura ſubeſt. Non omnis fert omnia tellus*. This ſeminary ſpirit of minerals hath his proper wombes where it reſides, and is

De gen. animal. lib. 2.

Foxius, Martinus, Moriſinus, Magyrus, Libavius, Velcurio, Valeſius, Caverius, Eraſtus, &c.

is like a Prince or Emperor, whoſe preſcripts both the Elements and matter muſt obey : and it is neuer idle, but alwayes in action, producing and mayntaining naturall ſubſtances, vntill they haue fulfilled their deſtiny, *donec fatum expleverint*, as *Hippocrates* ſaith. So as there is a neceſſity in this, depending vpon the firſt benediction (*creſcite & multiplicamini* :) and this neceſſity or *fatum* is inherent in the ſeeds, and not aduentitious from the Planets, or any other naturall cauſe. And this is the cauſe of the vniformity in euery ſpecies, that they haue all their proper figures, dimenſions, numbers of parts, colours, taſts, &c. moſt conuenient and agreeable to each nature ; as *Moſes* ſaith, that God ſaw that euery thing was very good : and *Galen* ſaith, *Deus in omnibus optimum eligit*. And this I take to be the meaning of his *Lex Adraſtiæ*, which hee alleageth againſt *Aſclepiades*. For if hee ſhould meane it as commonly it is vnderſtood, of puniſhment which alwayes follows ſinne, *nemo crimen in pectore geſtat, qui non idem Nemeſin in tergo* : in this ſenſe he could not apply it to the confuting of *Aſclepiades*. There are alſo other lawes in nature which cannot be altered, both Mathematicall, in Arithmetick and Geometry, and Logicall, in the conſecuting of arguments, &c. But theſe ſerue not for *Galens* purpoſe in this place. He muſt meane it of a naturall neceſſity or *fatum*, or predeſtination, frames euery member and part of the body to the beſt vſe for the creature. And therefore where *Aſclepiades* propounds an inconuenient frame of parts, he confutes him by this inbred law of nature, which hee ſaith, no man can alter or auoid, nor any ſubtilty elude, as *Ariſtotle* alſo ſaith. Thus much for the generation of Minerals and other naturall ſubſtances.

De Diæta lib. 1.

6 De uſu partium cap 12. & 13

Eraſmus in Adagiis.

De mundo c. ult.

Cap. 13.

Of the cauſes of actuall heat, and medicinable virtue in Minerall waters, diuers opinions of others, reiected.

NOw I come to ſhew how our Minerall waters receiue both their actuall heat, and their virtues. I ioyne them together, becauſe they depend vpon one and the ſame cauſe, vnles they bee iuyces which will readily diſſolue in water, without the helpe of heat: other Minerals will not, or very hardly.

This actuall heat of waters hath troubled all thoſe that haue written of them, and many opinions haue beene held of the cauſes of them.

Some attribute it to wind, or ayre, or exhalations included in the bowels of the earth, which either by their owne nature, or by their violent motion, and agitation, and attrition vpon rocks and narrow paſſages, doe gather heat, and impart it to our waters. Of their owne nature theſe exhalations cannot bee ſo hot, as to make our water hot, eſpecially ſeeing in their paſſage among cold rocks, it would bee much allaied, hauing no ſupply of heat to maintaine it. Moreouer, where water hath paſſage to get forth to the ſuperficies of the earth, there theſe exhalatious and winds will eaſily paſſe, and ſo their heat gone withall, and ſo our waters left to their naturall coldneſſe: whereas wee ſee they doe continue in the ſame degree and tenor, many generations together. If by their agitation and violent motion they get this heat, becauſe no violent thing is perpetuall or conſtant, this cannot be the cauſe of the perpetuall and conſtant heat of water. Beſides, this would rather cauſe earthquakes and ſtormes, and noyſes in the earth, then heat our ſprings. Moreouer, wee daily obſerue, that exhalations and water are neuer heated by motion, or agitation; as in the Cataracts of the Rhein by Splug; the agitation and fall of water vpon rocks is moſt violent, and make a hideous noyſe; yet it heats not the water, though it bee very deepe in the earth. Neither can any attrition heat either ayre, or water, or any ſoft and liquid thing, but rather make it more cold.

Valeſius contro. lib.4.cap.3.
Solinand.l.1.c.4.

Others attribute this actuall heat of Bathes vnto the Sunne, whoſe beames peircing thorow the pores of the earth, doe heat our waters. If this heat which heats our Bathes be cauſed by the beames of the Sunne, then either they bring it intirely from the Sunne, as a quality proceeding from thence, or they make it by their own motion. If it come from the nature of the Sunne, the Sunne muſt bee extreame hot that can heat theſe inferior parts at ſuch a diſtance: eſpecially the beames which muſt carry it, paſſing thorow the middle region of the ayre, which is alwayes extreame cold, and cannot but coole thoſe beames before they come to vs. And if they were able to paſſe that region without loſing their heat, yet they cannot but warme that region, being nearer to their fountaine of heat, as well or better then they can warme our waters, in deſpite of any Antiperiſtaſis. But it is doubtfull whether the Sunne bee hot of his owne nature or no. The Peripateticks hold it to be hot and dry moderately; yet it muſt be extreme hot, if in this manner it doe heat our Bathes. And if the Sun be capable of heat, they muſt alſo make it capable of cold (elementary qualities) and then they make celeſtiall bodies obnoxious to generation and corruption; which they are not willing to grant. Although in this reſpect they need not feare the decay of the Sun, no more then of the globe of the earth: which though it ſuffer in his parts many alterations, yet the whole remaines firme and perpetuall, as M. Doctor *Hakwell* proues in his learned worke vpon that argument; and will ſo doe vntill it bee diſſolued by that omnipotent power which framed it. If they make this heat to come from the motion of the Sunne, wee muſt conſider how the Sunne by motion may get ſuch a heat. The Sunne is either moued by his owne motion, or as hee is carried in his Speare wherein he is fixed. If by his own motion, it muſt bee either by volutation vpon his *axis*, which is called κύλισις, or by circumgyration, which is called δίνησις, round about the globe of the earth: and this is the common opinion; which if it be ſo, he muſt be carried more ſwiftly then a bullet out of a peece of Ordnance. I read in the Turkiſh Hiſtory at the ſiege of *Scodra*, of a bullet of twelue hundred weight ſhot out of a Cannon called the Prince, and it ſeemes a great matter. But to haue ſuch a bullet as the globe of the Sunne, which is held to be 166 times bigger then the globe of the earth, to bee carried in a ſwifter courſe, and that perpetually, is a monſtrous, furious, and mad agitation, *inſanus motus*, as one termeth it. The like may be ſaid of the motion of the Speares: but I will leaue the confutation of this to others. But admit it to be ſo, and that this violent agitation is not repugnant to the perpetuity of the heauens; and that it is able to breed an extreme heat in the Sun and celeſtiall Spheres, notwithſtanding their tenuity, &c. which is vnapt to breed heat by motion or colliſion, for that is proper to ſolid ſubſtances: yet this heat muſt bee conueyed to vs by the ſame beames of the Sunne, and muſt bee ſubiect to the former impediments.

Gilbertus de magnete lib 6.
Taurellus de primis rerum principijs.
Conrad. Aſlacus de triplici cœlo.

Wherefore the beames of the Sunne by their motion muſt make this heat, by the collection of many beames together. For if they be diſperſed, no fire will bee kindled, but only ſome moderate heat: as wee ſee in a burning glaſſe, which will heat a white paper or cloth, but not burne it. Other things it will burne, which are apt fewels; but the whitenes of the paper or cloth it ſeemes diſperſeth the beames. But no doubt the Sunne by his light and beames do warme theſe inferior parts, eſpecially where they haue free paſſage, and reflection withall, and it is to be iudged, that the heat not being eſſentially in the Sunne, is an effect of the light by whoſe beames it is imparted to vs: So as where light is excluded, heat is alſo excluded. And if wee can exclude the heat of the beames of the Sunne by the interpoſition of a mud wall, or by making a Cellar ſix foot vnder the ground; how is it likely that theſe beames can pierce ſo deepe into the earth, as to heat the water there? as *Lucretius* ſaith,

Qui queat hic ſubter tam craſſo corpore terram
Lib. 6. *Percoquere humorem, & calido ſociare vapori?*
Præſertim cum vix poßit per ſepta domorum
Inſinuare ſuum radÿs ardentibus æſtum.

And if the beames of the Sunne be not able to heat a a ſtanding Poole in the midſt of Summer, how ſhould they heat a ſubterraneall water, which is alwayes in motion, eſpecially in the winter time? Againe, if this heat come from the Sunne, then in the Summer, when the Sunne is hotteſt, the waters ſhould bee ſo alſo, and in winter cold, becauſe of the abſence of the Sunne; but we finde them alwayes alike. Alſo why ſhould the Sunne heat ſome few fountaines and paſſe ouer an infinite number of others, which are left cold? And why ſhould there bee hot fountaines in cold Climats, where the Sunne hath little power to heat, either by reaſon of his oblique beames, or by reaſon of his long abſence; and yet in hot Climats they ſhould be ſo rare? wherefore it is very improbable that our ſprings are heated by the Sunne.

Others haue deuiſed another cauſe of this actuall heat of Bathes, more vaine then the former, which they call Antiperiſtaſis: where by reciprocation or compreſſion, any quality is intended and exalted to a higher degree. As where heat or cold are compaſſed by their contrary quality, ſo as the vapors or *effluvium* of it is reflected back againe, the quality thereof is encreaſed. *Hippocrates* giues vs an example of it in our owne bodies, where he ſaith, *ventres hieme calidores*, our ſtomachs are hotter in Winter then in Summer, by reaſon the ambient ayre being then cold, doth ſtop the pores of the skin, and repell thoſe fuliginous vapours which nature would breathe forth, and ſo our inward heat is encreaſed: whereas in the Summer, by reaſon of too much euentilation, our naturall heat is diminiſhed: and therefore we concoct better in winter then in Summer. And although it bee not ſimple heat which concocts, and makes *chylus* in the ſtomach, blood in the liuer, ſeed in the ſpermatick veſſels, or milke in the breaſt, &c. as *Ioubertus* ſaith: yet heat attending vpon the faculties of thoſe parts, doth quicken them, as cold doth benumbe them. But if we examine this example aright, wee ſhall finde a great difference betweene this and our hot Bathes. For the heat in our bodies is continually fed and maintainde from the heart by his motion: that of Bathes hath no ſuch ſupply according to their doctrine, from any cauſe to make or continue this heat. And therefore the repelling of vapours cannot make

In Paradoxis.

water hotter then it is : and being naturally cold, and without any heat ; where heat is not, how can it bee pend in or repelled? Againe, in *Hippocrates* his example there is an *interſtitium* (our skin) betweene the fuliginous vapours and the externall ayre, which keepe them from vniting : but in our Bathes there is nothing to hinder the meeting and coniunction of theſe qualities, and then the one muſt dull the other. Moreouer, we ſee that any thing that is naturally cold, as iron or a ſtone, if it bee made hot accidentally by fire or otherwiſe, it is ſooner cold in cold ayre, then in a warme place. So that the Antiperiſtaſis doth rather diminiſh then encreaſe the heat of it. Wherefore vnleſſe water were naturally hot, or the heat maintained by ſome continuall cauſe, this Antiperiſtaſis can doe no good, but by his oppoſite quality would rather coole it. Nay heat it ſelfe cannot make any thing more hot, vnleſſe it bee greater then the heat of the thing it ſelfe. But to aſcribe the generation of heat to cold, and ſo to make it the cauſe of his contrary, is againſt the law of Nature. No quality of it ſelfe is encreaſed by his contrary. It is true, that a pot of water ſet ouer the fire, will bee ſooner hot, being couered, or otherwiſe the vapours kept in, then being open : but there muſt be fire then to heat it, and to continue the heat : otherwiſe the Antiperiſtaſis will doe nothing, vnleſſe it make it more cold, and congeale it into yce, if the ayre ambient be more cold then the water. Some may obiect, that they finde ſome fountaines warmer in Winter then in Summer, and to reak when they breake forth into the ayre ; as I haue ſeene at *Wickſworth* and *Bakewel* in Darbyſhire : and therefore this doth argue an Antiperiſtaſis. *Galen* thinkes that theſe waters do but ſeem ſo to our ſenſe: our hands being hot in Summer, and cold in Winter, as our veins

3. Simpl. medic. facult. cap. 7.

ſeeme cold in a hot Bath. But I will grant with *Valeſius* that many deepe fountaines may bee ſo indeed, and not in appearance only, as partaking with ſome warme exhalations, eſpecially in Minerall Countreys, as Darbyſhire is.

Moreouer, if our Bathes were heated by an Antiperiſtaſis, then they ſhould bee hotter in Winter then in Summer; but wee finde them alwayes alike. Alſo if a cold ambient bee able to make cold water hot, why ſhould not a hot ambient make it more cold? eſpecially ſeeing the vapours are cold, which being repelled by heat, which doth terminate cold, ſhould encreaſe the coldneſſe of the water. Alſo if we ſhould grant this Antiperiſtaſis, wee muſt deny the reaction and reſiſtance betweene the qualities of the Elements: and ſo ouerthrow all temperaments which ariſe from thence: and alſo our compoſition of medicines were in vain. Wherefore this Antiperiſtaſis is an idle inuention to maintaine this purpoſe.

Valeſius contro: lib.1.cap.5.
Magyrus lib.3. cap.3.

Others attribute this actuall heate to quicke Lyme, which wee ſee doth readily heat any water caſt vpon it, and alſo kindle any combuſtible ſubſtance put into it; this is *Democritus* his opinion. To this I anſwer, that Lyme is an artificiall thing, not naturall, and is neuer found in the bowels of the earth. Beſides, if it were found, one fuſion of water extinguiſheth the heat of it, and then it lyeth like a dead earth, and will yeeld no more heat. So as this cannot procure a perpetuall heat to Bathes: neither can the Lymeſtones without calcination, yeeld any heat to water, nor will breake and crackle vpon the affuſion of water, as Lyme doth. Wherefore this opinion is altogether improbable.

Others attribute this actuall heat to a ſubterraneall fire kindled in the bowels of the earth. Let vs conſider how this may be. Fire is a quality, and the higheſt degree of heat, which cannot ſubſiſt without a ſubiect: For I define it to be *intenſiſſimus calor in corpore cremabili:* aud it is receiued into his ſubiect either by propagation or coition, as when one candle lights another, or by motion, as colliſion, concuſſion, dilatation, compreſſion, putrefaction, fermentation, reflection, &c. yet all motion doth not kindle fire although it heat; neither are all ſubſtances apt to be heated by motion. Ayre and water are rather colder by motion: But this rule holds in ſuch things as are apt to receiue heat by motion, as ſolid ſubſtances, combuſtible ſubſtances, &c. And the heat of animals, vegetables, and minerals, which they haue for their generation and nutrition, is from motion: although this heat is not in ſo high a degree as fire is: for then it would conſume them; but as the motion is moderate, and agreeable to each nature, ſo is the heat. This motion in naturall things proceeds from their ſeeds or formes, and may be called internall or naturall. Externall motions are violent agitations, concuſſions, &c. which commonly kindle fire in apt matter. As for the element of fire, which ſhould bee pure, not ſhining, and therefore inviſible, and ſubſiſting without a ſubiect or fewell: let them finde it who know where to ſeeke for it. For my part I know no element of fire, vnleſſe we ſhould make it to be that which is naturall to all creatures and their ſeeds, cauſing their fermenting heat, whereof I ſhall ſpeake anon. And this interpretation we may well make of *Hippocrates*, where he ſaith, that all things are made of fire and water: and that theſe two are ſufficient for all generations: fire giuing motion, and water nutrition. And it is not likely that this fire ſhould be fetched from a remote place, and downwards, againſt the nature of fire, for euery generation:

De dieta lib.1:

tion: but that it be neare hand, and inbred in the ſeeds themſelues, as the principall ingredient into euery naturall thing: whereas if it were remote, what ſhould bring it continually, and vnite it with the other elements in theſe generations! Wherefore this is moſt likely to be the element of fire. Our burning fire is all of one nature, not differing in kinde, but only in degree according to the quality of the fewell. Some fewels will make a manifeſt flame, as all thinne and light ſubſtances, Sulphur, liquid Bitumen, Oyle, Fat, &c. Some onely a glowing coale, with little or no flame, as ſome ſorts of Stonecoale. Yet all fire doth ſend forth fuliginous vapours, which would choake it if there were not vent for them into the ayre: as wee ſee in the making of Charcoale, although they couer their fire with lome, yet they muſt leaue ſome vent for the ſmok: though not ſo much as may make it to flame, yet enough to maintaine the fire. Of the firſt flaming ſort there are diuers degrees, as that of ſtraw, Brimſtone, ſpirit of wine, Naphtha, Petroleum, &c. Some of which will ſcarcely take hold vpon other fewell: as one may wet a linnen cloath in ſpirit of wine, and being kindled, he ſhall hardly finde the cloath ſcorched. The like hath beene obſerued in that exhalation which is called *ignis fatuus*, being of a very thin ſubſtance, from Bitumen or Naphtha. Some reckon Comets among theſe fiery exhalations: but I can hardly beleeue that they are any kindled ſubſtances. Firſt, becauſe their flame is not pyramidall, as it is in all kindled ſubſtances. Secondly, becauſe if they be of a thin ſubſtance from Sulphur and Bitumen, the flame would be greater, ſeeing it muſt bee plentifull, if it continue ſo long in burning, as we finde them to doe. Or admit that this matter bee kindled by ſucceſſion, yet it is incredible that it ſhould continue

Notandum

burning aboue a yeare together: as that Comet *Xiphias*, which laſted a whole yeare: Another, *Anno* 1572. vnder the conſtellation of *Caſsiopaa*, laſted a yeare and a halfe, others ſixe moneths, others three, &c. if the Sulphureous or Bituminous matter bee thicke, it will melt in burning, and raine downe Brimſtone and Bitumen vpon vs. Thirdly, if Comets were kindled ſubſtances, what entertainement could they finde aboue the Moon, and among the ſpheares, where they ſay no corruptible or elementary ſubſtance can be indured. But many of our Comets haue beene obſerued to haue beene aboue the Moone, and ſome among the fixed ſtarres, as hath beene obſerued by *Ticho Brache*, and *Clauius*: and vpon due obſeruation they could finde ſome of them to admit no Paralaxis, or diuerſity of aſpect to any ſtarre in different climats.

This argument may be good againſt a Peripatetick; but a Platoniſt, or a Pythagorean, who hold the heauens to be made of elementary matter, and ſubiect to generation and corruption, will not allow it, no more will many of our Diuines.

For glowing fires, we haue none but they muſt bee kindled, and then they muſt haue vent for their fuliginous vapours, and they muſt be kindled either by propagation or coition from ſome other fire, or by violent motion able to kindle them, which wee ſhall hardly finde in the bowels of the earth, where all is quiet, and no ſpace for any ſuch perturbation.

But they ſay there is an *ignis ſubterraneus*, which being kindled vpon Sulphur and Bitumen, diſperſeth it ſelfe among other Mynes of the like nature, and ſets them on fire. Now wee are come from heauen to hell, or to purgatory at the leaſt, which *Pythagoras* cals *materiam vatum falſiq́; pericula mundi*; The dreame of

Metamorph. 15.

Poets, and a forged feare. The largeſt deſcription of it is in *Virgil*: from whence both Diuines and Philoſophers deriue much matter: and *Baccius* doth beleeue that there is ſuch a thing in the center of the earth. But if wee obſerue *Virgil* well, wee ſhall finde that hee propounds it but as a dreame: for in the end of that booke he ſaith,

Sunt geminæ ſomni portæ; quarum altera fertur,
Cornea, qua veris facilis datur exitus umbris:
Altera candenti perfecta nitens Elephanto,
Sed falſa ad Cœlum mittunt inſomnia manes:

Æneid. 6.

Dreames haue two gates, the one is ſaid to be
Of Horne, through which all true conceits do flee:
The other framed all of Iuory rare,
But lets out none but ſuch as forged are.

Now ſaith he, when *Anchyſes* had led *Æneas* and *Sibylla* through hell, hee lets them forth at the Iuory gate (*Portaque emittit Eburna:*) As if he ſhould ſay; all that I haue related of hell, is but a fiction; and thus *Ludovicus Vives* interprets it in his Comment vpon this place.

I hope none will thinke that I deny a hell, but I approoue not of the aſsignement of it to the center of the earth, or that that fire ſhould ſerue, as *Baccius* would haue it, to further all generations in the earth: and as others, to be the cauſe of Fountaines, Windes, Earthquakes, Vulcanoes, Stormes, Saltneſſe of the Sea, &c. nor of the actuall heat of our Bathes, although it be the moſt common receiued opinion.

Firſt for the place, it is not likely that the center of the earth, whither all heauy things do tend, ſhould bee hollow, but rather more compact then any other part of the earth, as likewiſe *Valeſius* thinks: but if there be any concauities, they are betweene the Center and the Superficies; and theſe concauities being receptacles of water from the Sea, cannot alſo receiue fire. Theſe two will not agree together in one place, but the one will expell the other: for whereas ſome hold that Bitumen will burne in water, and is nouriſhed by it, it is abſolutely falſe, as experience ſhewes; and I haue touched it among the *Bitumina*.

Agricola.
Baccius l.1.c.19.

Moreouer, if the heat which warmes our Bathes did proceed from hence, there muſt bee huge veſſels aboue the fire to containe water, whereby the fire might heate it, and not be quenched by it. Alſo the vapours ariſing from hence, muſt bee hotter then water can endure, or be capable of: for as they aſcend towards the ſuperficies of the earth, they muſt needs be cooled as they paſſe by rocks, or elſe they could not be congealed into water againe: and after this congealation, the water hath loſt moſt of his heat, as we finde in our ordinary diſtillations of Roſewater, &c. where wee ſee our water to deſcend into the receiuer, almoſt cold; ſo that they cannot deriue our hot Bathes from hence.

Secondly, for the fire it ſelfe, although water and ayre may be receiued into the bowels of the earth, yet there is great difficulty for fire. For the other two neede no nouriſhment to ſupport them, as fire doth. If there be not competency of ayre to nouriſh the fire by venting his fuliginous vapors, howſoeuer there bee fewell enough, it is ſuddenly quenced, and ſuch huge and flaming fire as this muſt bee, will require more ayre then can there be yeelded: a great part thereof paſſing away through the ſecret creeks of rocks, and little or none entring through the Sea. And therefore daily experience ſhewes, that our minerall men are faine to ſink new Shafts (as they call them) to admit ayre to their works, otherwiſe their lights would goe out. Although one would thinke, that where many men may haue roome enough to work, there would be ſpace enough for ayre to maintaine a few lights. The like we ſee in Cupping-glaſſes, where the light goes out as ſoone as they are applied. Alſo there are no fires perpetuall, as hot Bathes are, but are either extinct, or keepe not the ſame tenor. Wherefore fire cannot bee the cauſe of this conſtant heat of Bathes. It muſt bee a contituall cauſe that can make a continuall heat. Alſo where fire is, there will be ſmoak, for as it breeds exhalations, ſo it ſends them forth. But in moſt of our hot Bathes wee finde none of theſe dry exhalations. Moreouer, fire is more hardly pend in then ayre; yet wee ſee that ayre doth breake forth: wherefore fire ſhould alſo make his way, hauing fewell enough to maintain it. So they ſay it doth in our Vulcanoes at Hecla in Iſeland, Ætna in Sicily, Veſuvio in Campania, in Enaria, Æolia, Lipara, &c. But it is yet vnproued that theſe eruptions of fire do proceed from any deep cauſe, but only are kindled vpon or neere the ſuperficies of the earth, where there is ayre enough to feed it, and meanes enough to kindle it by lightnings, or other caſuall meanes. Whereas in the bowels of the earth, there is neither ayre to nouriſh it, nor any meanes to kindle it; ſeeing neither the beames of the Sunne, nor Wind, or other Exhalations, nor any Antiperiſtaſis, nor Lyme, nor Lightnings can do it. For the ſame reaſons that exclude the beames of the Sunne and exhalations, will likewiſe exclude lightnings.

Thirdly, for the fewell, there are only two ſubſtances in the bowels of the earth, which are apt fewels for fire, Bitumen and Sulphur.

Donatus de aquis Lucenſibus lib.1.cap.18.

Sulphur is in ſuch requeſt with all men, as they think there can bee no hot Bath without it: nay many hold, that if water do but paſſe thorow a myne of Brimſtone, although it be not kindled, but actually cold, yet it will contract from thence, not only a potentiall, but an actuall heat. But we do manifeſtly finde, that neither all hot waters are ſulphurous, nor all ſulphurous waters hot (as is ſaid before in Sulphur.)

Geſner. Epiſt. lib.3.pag.90.

The Baths of Caldanella and Avinian, *in agro Senenſi, de Grotta in Viterbio, de aquis in Piſano, Divi Iohannis in agro Lucenſi, Balneum Geberſuilleri in Halſatia, &c.* are all hot, and yet giue no ſigne of Sulphur, either by ſmell, or taſte, or quality, or effect. Contrariwiſe that all ſulphurous waters are not hot, may appeare by the Bathes of Zurich in Heluetia, of Buda in Pannonia, at Cure in Rhetia, Celenſes in Germany. In Campania, betweene Naples and Puteolum, are many cold ſulphurous Springs. At Brandula *in agro Carpenſi, &c.* All which Bathes ſhew much Sulphur to bee in them, and yet are cold. And no maruell, for if we infuſe any ſimple, bee it neuer ſo hot potentially, yet it will not make the liquor actually hot. Wherefore this Sulphur muſt burne before it can giue any actuall heat to our Bathes; and then it muſt needs bee ſubiect to the former difficulties, and alſo muſt bee continually repaired by new generations of matter, which actuall fire cannot further, but rather hinder. The fire generates nothing, but conſumes all things.

Lib.1. cap.ult.

The like we may iudge of Bitumen, that vnleſſe it be kindled, it can yeeld no heat to our Bathes: as *Solinander* reports of a Bituminous Myne in Weſtfalia, *in agro Tremonenſi*, where going downe into the groue, hee found much water hauing the ſmell, taſte, and colour of Bitumen, and yet cold. *Agricola* imputes the chiefe cauſe of the heating of Bathes, vnto the fewell of Bitumen; *Baccius* on the other ſide to Sulphur. But in mine opinion, they need not contend about it. For, as I haue ſhewed before in the examples of Minerall waters, there are many hot Springs from other minerals, where neither Sulphur nor Bitumen haue beene obſerued to bee. *Iohn de Dondis*, and *Iulius Alexandrinus* were much vnſatisfied in theſe opinions, and did rather acknowledge their ignorance, then that they would ſubſcribe vnto them. I need not diſpute whether this fire bee *in Alveis*, or *in Canalibus*, or *in vicinis partibus*, *&c.* becauſe I think it is in neither of them.

Cap. 14.

The Authors opinion concerning the cauſe of actuall heat, and medicinable virtue in Minerall waters.

Wherefore finding all the former opinions to be doubtfull and weakly grounded concerning the cauſes of the actuall heat of Bathes; let mee preſume to propound another, which I perſwade my ſelfe to bee more true and certaine. But becauſe it hath not beene mentioned by any Author that I know, I haue no mans ſteps to follow in it.

Avia Doctorum peragro loca, nullius ante
Trita ſolo.

I trauell where no path is to be ſeene
Of any learned foot that here hath beene.

Which makes me fearfull in the deliuery of it. But if I doe erre in it, I hope I ſhall not be blamed; ſeeing I do it in diſquiſition of the truth.

I haue in the former Chapters ſet downe mine opinion concerning the generation of minerals, that they haue their ſeminaries in the earth repleniſhed with ſpirits, and faculties attending them; which meeting with conuenient matter and adiuvant cauſes, doe proceed to the generation of ſeuerall ſpecies, according to the nature of the efficient, and aptneſſe of the matter. In this work of generation, as there is *generatio unius*, ſo there muſt bee *corruptio alterius*. And this cannot bee done without a ſuperiour power, which by moyſture, dilating it ſelfe, worketh vpon the matter, like a ferment to bring it to his owne purpoſe. This motion betweene the agent ſpirit, and the patient matter, produceth an actuall heat (*ex motu fit calor*) which ſerues as an inſtrument to further this work. And this motion being naturall and not violent produceth a naturall heat which furthers generations; not a deſtructiue heat. For as cold duls, and benumbes all faculties, ſo heat doth quicken them. This I ſhewed in the example of Malt. It is likewiſe true in euery particular graine of Corne ſowne in the ground, although by reaſon they lie ſingle, their actuall heat is not diſcernable by touch; yet wee finde that externall heat and moyſture doe further their ſpiring, as adiuvant cauſes; where the chiefe agent is the generatiue ſpirit in the ſeed. So I take it to be in minerals, with thoſe diſtinctions beforementioned. And in this all generations agree, that an actuall heat, together with moyſture, is requiſite: otherwiſe there can neither be the corruption of the one, nor the generation of the other. This actuall heat is leſſe ſenſible in ſmall ſeeds and tender bodies, then it is in the great and plentifull generations, and in hard and compact matter:

for hard bodies are not ſo eaſily reduced to a new forme, as tender bodies are; but require both more ſpirit and longer time to bee wrought vpon. And therefore whereas vegetable generations are brought to perfection in a few months, theſe minerall generations do require many yeares, as hath been obſerued by Minerall men. Moreouer, theſe generations are not terminated with one production, but as the ſeed gathereth ſtrength by enlarging it ſelfe, ſo it continually proceeds to ſubdue more matter vnder his gouernment: ſo as, where once any generation is begun, it continues many ages, and ſeldome giues ouer. As we ſee in the Iron mynes of Illua, the Tinne mynes in Cornwall, the Lead mynes at Mendip, and the Peak, &c. which doe not only ſtretch further in extent of ground, then hath beene obſerued heretofore; but alſo are renewed in the ſame groues which haue beene formerly wrought, as our Tinners in Cornwall do acknowledge; and the examples of Illua and Saga before mentioned, doe confirme. This is a ſufficient meanes for the perpetuity of our hot Springs; that if the actuall heat proceed from hence, there need be no doubt of the continuance of them, nor of their equall tenor of degree of heat.

Now for the nature of this heat, it is not a deſtructiue heat, as that of fire is, but a generatiue heat ioyned with moyſture. It needs no ayre for euentilation, as the other doth. It is in degree hot enough for the hotteſt Bathes that are, if it bee not too remote from the place where the water iſſueth forth. It is a means to impart the qualities of minerals to our waters, as well as heat, by reaſon the minerals are then *in ſolutis principijs*, in their liquid formes, and not conſolidated into hard bodies. For when they are conſolidated, there are few of them that will yeeld any quality to water, vnleſſe they be the concrete iuyces, or any actuall heat, becauſe that is procured by the contiguity of bodies, when one part lyeth vpon another, and not when they are growne *in corpus continuum*; as we ſee in Malt, where by turning and changing the contiguity, the heat is increaſed, but by ſuffering it to unite, is quenched: But before conſolidation, any of them may yeeld either ſpirit, or iuyce, or tincture to the waters, which by reaſon of their tenuity (as is ſaid before) are apt to imbibe them. Now if actuall fire kindled in the earth, ſhould meet with theſe minerals whilſt they are in generation, it would diſſipate the ſpirits, and deſtroy the minerals. If it meet with them after conſolidation, it will neuer be able to attenuate them ſo, as to make them yeeld their qualities to water. For wee neuer finde any metals or minerals melted in the earth, which muſt be, if the heat of actuall fire were ſuch as is imagined: neither doe wee euer finde any flores of metall ſublimed in the earth. This naturall heat is daily found by our Minerall men in the Mines, ſo as oftentimes they are not able to touch them, as *Agricola* teſtifieth; although by opening their groues and admiſſion of ayre, it ſhould be wel qualified. Whereas on the other ſide, it was neuer obſerued, that any actuall kindled fire was euer ſeene by workmen in the earth, which were likely to be, if theſe fires were ſo frequent.

Thurneiſer Alchimię magna lib.4.c.8.

Wherefore ſeeing we ſee that Mineral waters do participate with all ſorts of Minerals, as well metals as other, as hath beene ſhewed in the particular examples of all of them: ſeeing alſo that few of them, vnleſſe Minerall iuyces, are able to impart their quality to water, as they are conſolidated, but only as they are *in ſolutis principijs*, and whilſt they are in generation, as is agreed vpon by all Authors: ſeeing alſo this naturall heat of fermentation muſt neceſſarily be preſent for the perfecting of their generation, and is ſufficient, in regard of the degree of heat to make our Bathes as hot as they are: ſeeing alſo that the other aduentitious fire would rather deſtroy theſe Minerals, then further them: ſeeing alſo we cannot imagine it either likely, or poſſible, without manifold difficulties, and abſurdities: I doe conclude that both the actuall heat of Bathes, and the Minerall qualities which they haue, are deriued vnto them by meanes of this fermenting heat. Which is ſtill *in fieri*, not *in facto eſſe*, as the Schoolmen term it: and therefore makes the heat continuall.

Examples might be brought from all kinde of generations, and from ſome artificiall workes, of this fermenting heat proceeding from the ſeeds of naturall things. Theſe ſeeds containing the ſpecies and kindes of naturall bodies, are not from the Elements, but are placed in the Elements, where they propagate their ſpecies, and indiuiduals, according to their nature; and haue their due times and ſeaſons of appearing vpon the Stage of the world. Animals haue their ſet times when their ſpermatick ſpirits are in turgeſcence, ſome once, ſome twice a yeare, and ſome oftner: eſpecially in the Spring; *vere magis, quia vere calor redit oſſibus*; as *Virgil* ſpeakes of Mares: only man in regard of his excellency aboue other creatures, is not ſo confinde.

Martin. de prima generatione.

Vegetables haue likewiſe their ſeaſons of ſetting and planting, as they may haue the earth and the ſeaſon moſt conuenient: yet at any time, if their ſeeds get moyſture and heat to dilate them, they will ferment and attempt the production of moe indiuiduals: but oftentimes the Artiſt doth abuſe this intention of nature, and conuerts it to his ends: and oftentimes nature being ſet in action to proceed *à potentia in actum*, doth want conuenient meanes to maintaine her worke: as when we ſee a Ryck of Hay or Corne which hath receiued moyſture, burnt to aſhes. So in the making of Malt, or Woad, or Bread, or Beere, or Wine, &c. wee make vſe of this generatiue ſpirit for our ends: that we may ſtirre vp, and quicken it. Otherwiſe our Bread would not be ſo ſauory, our Beere would be but Wort, our Wine would bee but Muſt, or Plumpottage, and want thoſe ſpirits which we deſire; and which lie dead and benumbed in the ſeeds, vntill they come to fermentation. And in all theſe there is an actuall heat, although it appeare not in liquid things, ſo well as in dry: becauſe it is there quenced by the abundance of moyſture; yet wee may obſerue actiue ſpirits in it, by the bubling and hiſſing, and working of it. This is euident in artificiall Wines, which may bee made of Figs, Dates, dried Reyſins, Currants, Slowes, Strawberries, Brambleberries, and ſuch like, when they are infuſed in water. They will ferment of their owne accord, by vertue of the ſeeds which are in them, and make as good and as naturall Wine as the iuyce of the greene fruit, as I haue often proued. The Turks haue a drink which they call Couſet or Poſſet, which is made of Barly after ſuch a manner, as *Bellonius* reports in his obſeruations. *Lib. 2. cap. 98.* It ſeemes alſo that the Scythians drink was made in this manner, which *Virgil* ſpeaks of.

Georg. 3.

Hic noctem ludo ducunt; & pocula læti
Fermento atque acidis imitantur vitea ſorbis.

And I perſwade my ſelfe that we haue not yet attained to the perfect artifice of our Beere and Ale, which ſtands vpon the ſame grounds, and may bee wrought in ſuch a manner, if any would take the paines to try ſome concluſions vpon it. It might ſaue much fewell, and veſſell, and labour, and perhaps with aduantage in the product. For I ſee but two points to be obſerued in the working of it: the one is to extract the ſubſtance of the Malt into water: the other to giue it his due fermentation. And both of theſe may be done without boyling. But the artifice will differ ſomwhat from Wine, and will require many concluſions to be tryed vpon it, before it be brought to perfection. I do mention theſe artifices only to ſhew the power of this ſeminary and fermenting ſpiririt, and how it may be drawne to other vſes for our benefit. As this is found in vegetables, ſo likewiſe in Minerals; which as they haue this generatiue ſpirit for the propagation of their ſpecies, as hath beene ſhewed before, ſo they haue this meanes of fermentation, to bring them from a potentiall quality, to an actuall exiſtence. And as their matter is more plentifull, and in conſiſtence more hard and compact; ſo theſe ſpirits muſt be more vigorous and powerfull to ſubdue it: and conſequently the heat of their fermentation muſt be in a higher degree, then it is in other generations.

Now hauing ſhewed the erroneous opinions of others concerning this actuall heat of Bathes, and explaind our owne conceit of the true cauſe of it; let vs collect our arguments together, the principall whereof are here and there diſperſed in this Treatiſe, *quem nos ſtramineum pro tempore fecimus*, hoping that hereafter ſome worthy pen may handle this argument more accurately, and giue it a better flouriſh, *& dare perpetuo cæleſtia fila metallo*. We muſt not imagine that the gouernment and ordering of the world and nature in a conſtant courſe, is performed by miracle, but that naturall effects haue naturall cauſes, and muſt be both vnder the ſame *genus*. Wherefore following the ordinary diſtribution, ſeeing it comprehends all, and not queſtioning the celeſtiall bodies, whether they be Elementary or no, that is, ſubiect to alterations, as intention and remiſſion, generation and corruption, &c. Wee ſay that this heat muſt proceed either from the ſuperior and celeſtiall bodies, as the Spheares and Starres, or from the inferior or ſublunary.

From the ſuperior Spheares or Globes it cannot proceed, ſeeing (as is ſhewed before) they are neither indowed with ſuch a degree of natiue heat, nor can acquire it accidentally by their motion, being thinne and liquid bodies; neither, if they had it, can they conuey it vnto the earth, but by their beames, which are not able to reteine it as they paſſe thorow the cold region of the ayre, nor able to warme that, although it bee neerer to their fountaine of heat. Wherefore if theſe beames can any way do it, it muſt be by their motion and reflection vpon the earth: and this is no conſtant heat, but varieth according as the beames are perpendicular or oblique, and according as the ayre is cleere or cloudy, &c. And as they are not able to giue this conſtant heat, ſo the earth in her bowels is not capable to receiue it, being hindered by the denſity of the earth and rocks, and the heat of reflection taken away before it come three foot deep.

From the inferior parts of the world if it proceed, it muſt bee either from the Elements, or from mixt bodies. From the Elements it cannot come, but from fire; for all the other Elements are cold, as I haue ſhewed, eſpecially the earth where this heat is ingendred.

And as for the Element of fire, ſeeing wee know not where to finde it, neither, if it be any where, doth it performe

forme the office of an Element in production and nutrition of creatures; as *Ariſtotle* ſaith, *Ignis nil generat*, and therefore *nil nutrit; nam nutritio fit ex iiſdem ex quibus conſtat*: therefore as it begets nothing, ſo it nouriſheth nothing; and ſo cannot be an Element, nor as an Element maintain this heat of Bathes. But contrariwiſe if it haue no power of begetting or nouriſhing any thing, it muſt haue a power of deſtroying or hindering nature in her proceedings; for nature will admit of no *vacuum* or idle thing. Alſo ſeeing nature vſeth no violent meanes to maintain her ſelfe, this Elementary fire cannot be pend in the center of the earth, being of a thin ſubtill nature, and naturally aſpiring vpwards: and if it haue any place aſſigned vnto it, it muſt bee aboue the other Elements, and then it cannot be drawne downwards againſt his nature, and that continually, without breach of the order and courſe of nature. And whereas they place the Element of fire vnder the concaue of the Moone, being in it ſelfe lucid and reſplendent, it is ſtrange that it is not ſeen by vs, neither makes our nights light. For although by reaſon of his tranſparency it doth not terminate our ſight, yet it ſhould remoue the obſcurity of our nights much better then the *Via lactea*. Moreouer, if it were there, wee muſt ſee the Starres through a double *Diaphanum*, one of ayre, and another of fire, and ſo would make a double refraction: which is elegantly confuted by *Iohn Pena* and *Conradus Aſlachus*.

3 de gen animal.
2 de gen. animal. cap. 3.

In præfat. in Opticum Euclidis.
De triplici cœlo lib. 1. cap 4.

But there is another thing ſubſtituted in the place of this Element of fire, and maintained by ayre, and by minerall ſubſtances in the earth; which is neither an Element, nor a mixt body, nor any ſubſtance at all, but a mere quality: and this is preferred by moſt to bee the cauſe of the heat of our Bathes. And this is our common kitchin fire, which is kindled by violent motion, maintained by fewell, without which it cannot ſubſiſt, and extinguiſhed by his contrary. And although it may be deriued by communication or coition, as one candle lights another, yet originally it is kindled by violent motion, and what violent motion can there bee in the bowels of the earth to ſtrike fire, or who ſhall bee the feweller? Exhalations and lightnings cannot do it, being aëreall meteors, and no more penetrable then the beames of the Sunne. And therefore although they may kindle a Vulcano vpon the ſurface of the earth, yet they cannot pierce deep, and their very reflection vpon the ſuperficies of the earth takes away their ſtrength; ſo as they can neither kindle new fire, nor communicate that which is kindled to any other fewell. For if it bee by communication or coition, that muſt bee by touch, *per contactum*, and then in the earth it can make but one fire, and not many, being not diſtinct in place, and muſt increaſe the heat: and then it will not keepe a conſtant tenor, as our Bathes doe.

Secondly for the nouriſhment of it, being a quality, it muſt haue a ſubiect, that is fewell, and it muſt haue meanes to vent the fuliginous vapours which it breeds in the diſſolution of the fewell, leſt they recoyle and quench the fire; as alſo there muſt be conueyance for the aſhes which will fall downe continually vpon the fire, and quench it. Moreouer, by conſuming ſuch great quantities of Sulphur and Bitumen, and by mollifying and breaking of rocks, it would cauſe a great ſinking of the earth in thoſe places; as wee ſee in our Vulcanoes, where whole mountaines haue beene conſumed and brought to euen ground.

Thirdly, this fire being a quality, is ſubiect to intention and remiſſion, and to vtter extinguiſhment, not only ly by want of fewell, which cannot bee regenerated where this actuall fire is, nor for want of vent, or choaking of aſhes, &c. but alſo by reaſon of the abundance of water which the earth receiueth for the generations of Minerals, which being oppoſite to fire, would quench it. Wherefore we cannot rely vpon any ſubterraneall fire for the maintenance of our hot Bathes.

From the ayre this heat of Bathes cannot proceed, ſeeing it is neither hot in it ſelfe, as hath beene proued, nor can get any heat by motion, being of a thin liquid ſubſtance, which no attrition or colliſion can make hot. And as for aëreall meteors, bred from exhalations, and kindled, as is imagined, by an Antiperiſtaſis: if they bee bred in the ayre, they are not able to penetrate into the bowels of the earth, as hath beene ſaid before: if in the earth, beſides the difficulty of finding roome enough for ſuch plentifull exhalations as thoſe muſt bee which procure lightning and thunder, and the vanity of their Antiperiſtaſis to kindle theſe exhalations, as hath beene ſhewed before; it is a ſufficient refutation to take away the ſubiect of the queſtion, that is, all ſubterraneall fire, as I hope I haue done: and then wee need not diſpute about the meanes of kindling it, &c. theſe momentany meteors being produced onely to kindle, and not to maintaine this fire.

From the water no man will deriue this fire, being a cold and moiſt Element, and apt to quench it: vnleſſe it be by dilating the ſeminary ſpirits of naturall ſpecies; and then they concurre with vs, and renouncing the actuall fire, do confirme our heat of fermentation.

From the earth ſome haue imagined an inbred heat, *ingenitum terræ calorem*, whereby it ſeemes they had ſome glimmering of this light which wee haue giuen, but haue left it in as great obſcurity as the Antiperiſtaſis or Antipathy : and earth being a cold and dry Element, cannot be the cauſe of this heat, as it is earth.

So as it is manifeſt that naturally the Elements cannot procure this heat of Bathes ; and by violent motion they can do as little. For the earth being immoueable, cannot be ſtirred by any violent motion : and the other three Elements, as fire, ayre, and water, being thin and liquid ſubſtances, can procure no heat by any motion or colliſion either vpon themſelues, or vpon the earth ; eſpecially in the bowels of the earth, where all is quiet, and no roome or ſcope for any ſuch motion as this muſt be. So that neither the other three Elements, nor the earth, either in the whole, or in the parts, can bee the cauſe hereof by any violent motion.

From mixt bodies if this heat come, it muſt bee from animals, vegetables, or minerals. Animals are not ſo plentifull in the earth as to cauſe this heat of Bathes, either aliue or dead. We read of ſubterraneall animals which haue both motion, and ſenſe, and vnderſtanding, in *Vincentius in ſpeculo naturali*, in *Lactantius*, in *Agricola, de animantibus ſubterraneis*, in *Bellonius, Ortelius, Paracelſus, &c.* who cals them *Gnomi*, the Germanes *Bergmaenlin*, the French *Rabat*, the Corniſhmen *Fayries*. The Danes are generally perſwaded that there are ſuch ſuch creatures. But if any ſuch liuing creatures be able to procure this heat, it cannot bee by their hot complexions, but it muſt be by violence and ſtriking of fire. Perhaps *Democritus* hath hired them to make his lyme there, or ſome other to erect forges for thunder, lightning, and ſuch like fire-works.

Bronteſq́; Steropeſq́; & nudus membra Pyracmon.

But theſe opinions deſerue no confutation.

From dead animals in their putrefaction ſome heat may appeare, but ſuch as neither for the degree, nor for the continuance, can be anſwerable to our Bathes.

For vegetables there is the ſame reaſon as for dead animals; neither doth the earth breed ſuch plenty of theſe in her bowels, as to procure a months heat to a tun of water, in one place.

Wherefore wee haue nothing to ground vpon but Minerall ſubſtances, whereof the earth affords enough.

For there is no part of the earth but is repleniſhed with minerall ſeeds. And although ſome may thinke that becauſe minerals are not found, or not wrought in all places: and that ſome waters are alſo found which do not participate of the vertues of minerals, that thereſore our hot Bathes proceed not from the fermentation of minerals, but from ſome other cauſe; they are miſtaken. For although metals are not frequent in ſome places, or at the leaſt not diſcouered; yet a man ſhall hardly dig ten foot deep in any place, but he ſhall finde rocks of ſtone, which haue their generation as well as other minerals, or ſome of the Salts, or *Bitumina*, or Spirits, or meane metals, &c. And how can Bathes receiue minerall qualities, but from minerals? Therefore where Bathes are, there muſt be minerals, although where minerals are, there are not alwayes Bathes. But perhaps they are not ſo accumulated, as by their contiguity they are able to yeeld any manifeſt heat; their matter being diſperſed as graines of corne ſown in a field, which by reaſon of their lying ſingle, do not ſhew a ſenſible heat in their fermentation; or moſt metals breeding between a Hanger and a Lieger, which *Agricola* cals *pendens* and *iacens*, are ſeldome aboue a foot thick, and therefore cannot yeeld much heat to our waters. And this is the cauſe why wee haue ſo few Bathes from Gold, Siluer, Tinne, Lead, &c. But where much matter is accumulated together, the very contiguity

guity (one part lying vpon another) will make a manifeſt heat, vntill it grow to a *corpus continuum*, when the generation is perfected, and then the heat is extinguiſhed. Or perhaps they haue not water ſo plentifull as may yeeld a liuing ſpring, although they may haue ſufficient for the vſe of their generation. Or perhaps where they break forth, they meet with deſert ſands, as in *Arabia*, *China*, *Affrica*, *&c.* which drink vp the water, and hinder the eruption of it. And whereas there are ſome hot ſprings found which do not ſhew any mineral quality in them, the reaſon of this may be the want of concrete iuyce, which, as I haue ſaid before, is the *medium* of communicating minerall qualities and ſubſtances with wateer. For without them, water is as vnapt to imbibe minerals, as it is to vnite with oyle. So as water may of it ſelfe receiue actuall heat from the fermentation of minerals, but not their qualities, without the mediation of ſome of the concrete iuyces: as contrari wiſe we finde ſome fountaines that receiue minerall qualities, and yet are cold: whereof I haue giuen many examples. The reaſon whereof is either for that they haue paſſed a long way, and by many Meanders from the place of generation to the place of their eruption, and ſo haue loſt their heat: or elſe the concrete iuyces, which will diſſolue in water without any heat, being impregnated with other mineals, do impart them to water, and yet without heat. But to ſay that there is any earth without minerall ſeeds, is to make a *vacuum in rerum natura*, and to deſtroy the vſe of the Elements. It is true that the ſeeds do not alwayes meet with opportunity to diſplay themſelues, and ſomtimes they are faine to ſerue vnder other colours, which are more predominant: but there is no part of the earth without ſome ſeeds or other.

And from hence wee muſt deriue the originall of the actuall heat of Bathes: for nothing elſe in the world will ſerue our turn to procure ſo laſting and ſo vniforme a heat vnto them: and that not by kindling any actuall fire about them, For moſt of our minerals whereof our Bathes conſiſt, and from whence they receiue both their actuall heat and virtues, will not burne, neither haue any actuall heat in themſelues, being all cold to the touch, but receiue it by a fermenting heat which they haue in their generation: without which there is no generation for any thing. And this heat continues ſo long as the work of generation continues: which being once begun, doth not ceaſe in many ages, by reaſon of the plenty of matter which the earth yeelds, and the firmneſſe and ſolidity thereof. And although after that the minerals haue attained to their perfection, this heat ceaſeth, yet the generation extends further then where it firſt began, and enlargeth it ſelfe euery way, the works of nature being circular: ſo as the water which was heated by the firſt generation, cannot avoid the other ſucceeding generations, but muſt meet with them either behind or before, beneath or aboue, on the one ſide, or on the other (eſpecially ſeeing no generation can proceed without water:) and yet keepes the ſame tenor and degree of heat, according to the nature of the minerals fermenting, and to the diſtance from the place of eruption. And this is a farre more probable cauſe of the continuance of our Bathes, then any ſubterraneall deſtructiue fire can be, or any other of the ſuppoſed cauſes can yeeld. I do not deny but that hot Bathes may ceaſe and become cold; as *Ariſtotle* ſaith[2] of ſalt fountaines which are cold, that they were once hot, before the originall of their heat was extinct: which I interpret to bee when the work of generation

ceaſed,

[2] *Meteorol. c. 2.*

ceaſed, and the ſalt brought to his perfection. But I do not read of any hot Bathes that haue ceaſed: vnleſſe neere vnto ſome Vulcano, where either the ſincking of rocks hath altered the courſe of them, as at Tripergula and Baia, or the flaming fire which heated them at their eruption being extinguiſhed, as in the Æolian Ilands. Theſe Vulcanoes are farre more ſubiect to decay then our generatiue heat, becauſe they conſume their fewell; this doth not, but increaſeth it daily, *vireſq; acquirit eundo.* Of the other *Ovid* ſaith,

> *Nec quæ ſulphureis ardet fornacibus Ætna*
> *Ignea ſemper erit; neq; enim fuit ignea ſemper.*

But of this we can hardly bring an Inſtance of any that haue decayed; becauſe where a generation is begun, there ſeldome or neuer wants matter to propagate and enlarge it. And ſeeing minerals haue not their ſeeds in their indiuiduals, as animals and vegetables haue, but in their wombs, as hath been ſhewed before; it were to bee feared that there would be a decay of minerall ſpecies, and ſo a *vacuum* left in nature, if theſe generations ſhould be no more durable then the other. Animals are propagated by begetting of their ſpecies, the power whereof is in euery indiuiduall, which, no doubt, will not giue ouer this trade as long as the world laſteth. Vegetables are alſo fruitfull in their kinds, euery one producing 100, or perhaps 1000 ſeeds of indiuiduals yeerly, to perpetuate their ſpecies. Minerals haue no ſuch meanes, but onely haue their ſeedes in their wombs, whereby they are propagated: and if theſe generations, being longer in perfecting of their ſpecies, were not ſupplied with a larger extent for their productions; nature had been defectiue in not prouiding ſufficient meanes for their perpetuity, as well as for others, and might eaſily ſuffer a decay, and a vacuity of minerall ſpecies; which agrees not with the prouidence of nature, and the ornament of the world. The neceſſity hereof depends vpon the firſt benediction, (*creſcite & multiplicamini*) which; no doubt, belongs as well to minerals in their kinds, as it doth to animals and vegetables, and by virtue hereof wee ſee that they are propagated daily, as I haue proued before Cap. 11. And this is that neceſſity whereof *Hippocrates* ſpeaks, and that *fatum naturale inhærens rebus ipſis*, as *Lipſius* ſaith; and that *Lex Adraſtia* mentioned by *Ariſtotle* and *Galen locis ante citatis*, ſo firmly eſtabliſhed, as nothing can contradict it. Arithmetick, Geometry, & Logick, which are but attendants vpon nature, haue their principles ſo firmly grounded, as nothing can ſhake them; and ſhall wee think that nature it ſelfe is grounded vpon weaker foundations? wherefore we need not doubt of the perpetuity of theſe generations, but that as ſome parts attain to their perfection, ſo other parts will bee alwayes *in fieri* or *in via ad generationem*: whereby our Bathes will neuer faile of their heat or their virtues.

Triſmegiſtus in Aſclepio.c.7.8 In Pimandro c.1.

Lib. de conſtant.

This I hope is ſufficient for the confuting of other opinions, and the clearing of mine owne from all abſurdities, concerning the degree of heat, which is as much as the nature of water can endure without vtter diſſipation: concerning the equall tenor of the heat; the duration of it; the participation of minerall qualities, &c. The other kind of confirmation which wee call Apodeicticall, is alſo here and there diſperſed in this Diſcourſe: as that all minerals haue their continuall generation: that this generation is not without heat and moyſture, which do neceſſarily attend all generations:

that few minerall ſubſtances or qualities can bee imparted to water, but whileſt they are in generation, and yet we find them much impregnated with them: that our Miners do find an actuall heat, and in a high degree, in the digging of minerals, where the fermentation is not throughly extinct: that wee obſerue the like courſe of nature in the generations of animals and vegetables: that we are led to the acknowledgement hereof by many artificiall concluſions, and artifices &c. Wherefore I forbeare to make any larger repetition hereof.

And this is in briefe (though plainly deliuered) my opinion concerning the actuall heat of Bathes, and of the minerall qualities which we find in them; which I refer to the cenſures of thoſe that be learned.

There are two other motions which reſemble this fermentation The one is *Motus dilatationis*, the other *Antipatheticus*. *Motus dilatationis* is euident in Lime, in Allum, in Copperas, and other concrete iuyces, whereby the affuſion of water, the Salt in the Lyme, or the concrete iuyces being ſuddenly diſſolued, there is by this motion, an actuall heat procured for a time, able to kindle any combuſtible matter put to it.

The like we obſerue in thoſe ſtone Coales, called metall Coales, which are mixed with a Marcheſit containing ſome minerall iuyce, which receiuing moyſture, doth dilate it ſelfe, and growes ſo hot, as oftentimes great heapes of thoſe Coales are kindled thereby, and burnt before their time; as hath beene ſeene at Puddle Wharfe in London, and at Newcaſtle. But this is much different from our fermentation.

Another *Motus* reſembling this fermentation, is that which is attributed to Antipathy, when diſagreeing ſubſtances being put together, do fight, and make a manifeſt actuall heat; as Antimony and Sablimat, oyle of

Vitrioll, and oyle of Tartar, Allum liquor and Vrine, Lees, Chalk,&c. But the reaſon of this diſagreement is in their Salts, whereof one is aſtringent, the other relaxing; the one of eaſie diſſolution in water, the other of hard diſſolution, &c. where one minerall hinders the diſſolution or congelation of another: and not by reaſon of any antipathy: for it is not likely that nature would produce two contrary ſubſtances mixed like atomes in one ſubiect, but that in their very generations the one would bee an impediment to the other. So in vegetables where one plant ſucks away the nouriſhment from another, we call it antipathy. But if we examine aright what this ſympathy and antipathy is, we ſhall finde it to bee nothing but a refuge of ignorance, when not being able to conceiue the true reaſons of ſuch actions and paſſions in naturall things, wee fly ſometimes to indefinite generalities, and ſometimes to this inexplicable ſympathy and antipathy: attributing voluntary, and ſenſitiue actions and paſſions to inſenſible ſubſtances. This *motus* alſo is much different from fermentation, as may eaſily appeare by the former deſcription. And thus much for this point of fermentation, which I hope will giue better ſatisfaction then any of the former opinions.

Cap. 15.

By what meanes it may be diſcouered what minerals any water containeth.

THe nature of minerals and their generations being handled, and from thence the reaſons drawne, both of the actuall heat of Bathes, and of their qualities: Now it is fit we ſhould ſeeke out ſome meanes how to diſcouer what minerals are in any Bath, that thereby we may the better know their qualities, and what vſe to make of them for our benefit. Many haue attempted this diſcouery, but by ſuch weake meanes, and vpon ſuch poore grounds, as it is no meruaile if they haue failed of their purpoſe: for they haue contented thmſelues with a bare diſtillation or euaporation of the water, & obſeruing the ſediment, haue thereby iudged of the minerals, vnleſſe perhaps they finde ſome manifeſt taſte, or ſmell, or colour in the water, or ſome vnctuous matter ſwmming aboue it. Some deſire no other argument of Sulphur and Bitumen, but the actuall heate: as though no other minerals could yeeld an actuall heate, but thoſe two. But this point requires better conſideration, and I haue beene ſo large in deſcribing the natures and generations of minerals, becauſe without it, wee cannot diſcerne what minerals we haue in our waters, nor iudge of the qualities and vſe of them.

Our Minerals therefore, are either confuſed or mixed with the water. If they bee confuſed they are eaſily diſcerned: for they make the water thick and pudly, and will either ſwim aboue, as Bitumen will doe, or ſink to the bottome, as earth, Sulphur, and ſome terreſtriall iuyces; for no confuſed water will remaine long vnſeparated. If they are perfectly mixed with the water, then their mixture is either corporall, where the very body of the Minerall is imbibed in the water, or ſpirituall, where either ſome exhalation, or ſpirit, or tincture is imparted to the water.

Corporally there are no minerals mixed with water, but iuyces, either liquid, as *ſuccus lapideſcens, metallificus*, &c. before they are perfectly congeled into their naturall conſiſtence, or concrete, as Salt, Niter, Vitriol, and Allum. And theſe concrete iuyces do not only diſſolue themſelues in water, but oftentimes bring with them ſome tincture or ſpirit from other Minerals. For as water is apt to receiue iuyces, and tinctures, and ſpirits from animals, and vegetables; ſo are concrete iuyces, being diſſolued, apt to extract tinctures and Spirits from minerals, and to communicate them with water. And there are no Mynes, but haue ſome of theſe concrete iuyces in them, to diſſolue the materials of them, for their better vnion and mixture: and there are few minerals or metals, but haue ſome of them incorporated with them: as we ſee in Iron, and Copper, and Tinne, and Leade, &c. And this is the reaſon that water being long kept in Veſſels, of any of theſe metals, will receiue a taſte and ſmell from them, eſpecially if it be attenuated, either by heate, or by addition of ſome ſoure iuyce; and yet more, if the metals be fyled into powder as we ſee in making Chalibeat wine, or Sugar of Leade, or Puttie from Tinne, or Verdegreaſe from Copper. There may be alſo a mixture of Spirituall ſubſtance from minerals, whilſt they are in generation, and *in Solutis principijs*: the water paſſing through them, and the rather if it bee actually hot, for then it is more apt to imbibe it, and will containe more in it, being attenuated by heate, then being cold; as we ſee in Vrines, which though they bee full of humours, yet make no great ſhew of them ſo long as they are warme, but being cold, do ſettle then to the bottome.

Theſe ſpirituall ſubſtances are hardly diſcerned in our Baths, but by the effects; for they leaue no reſidence after euaporation; and are commonly as volutill in ſublimation as the water it ſelfe: neither doe they encreaſe the weight of the water, nor much alter the taſte or ſmell of them, vnleſſe they be very plentifull. Wherefore we haue no certaine way to diſcouer them, but by the effects. We may coniecture ſomwhat of them by the Mynes which are found neare vnto the Baths, and by the mud which is brought with the water. But that may deceiue, as comming from the paſſages through which the water is conueyed, or, perhaps, from the ſweat and ſtrigments of mens bodyes which bathe in them. The corporall ſubſtances are found, either by ſublimation or by precipitation. By Sublimation, when being brought to the ſtate of congelation, and ſtickes of Wood put into it, within a few dayes, the concrete iuyces will ſhoote vpon the wood; in Needles, if it bee Niter; in ſquares, if it be Salt; and in Clods and Lumps, if it be Allum or Coperoſe, and the other minerall ſubſtance which the waters haue receiued, wil either incorporate a tincture with them, or if it be more terreſtriall, will ſettle and ſeparate from it, and by drying it at a gentle fire, will ſhew from what houſe it comes, either by colour, taſte, ſmell, or vertue: There is an other way by precipitation, whereby thoſe minerall ſubſtances are ſtricken downe from their concrete iuyces which held them, by addition of ſome oppoſite ſubſtance. And this is of two ſorts: either Salts, as Tartar, Soape-Aſhes, Kelps, Vrine, &c. Or ſowre iuyces as Vinegar, Lymons, Oyle of Vitrioll, Sulphur, &c. In which I haue obſerued that the Salts are proper to blew colours, and the other to red: for example, take a piece of Scarlet cloath, and wet it in Oyle of Tartar (the ſtrongeſt of that kinde) and it preſently becomes blew: dip it againe in Oyle of Vitriol, and it becomes red againe. *Penotus* hath a ſtrange precipitaring water from tin, mercury, alkali, &c. which ſeparate any minerals, *Fides ſit penes authorem.*

Theſe are the chiefe grounds of diſcouering minerall waters, according to which any man may make tryall of what waters he pleaſeth. I haue beene deſirous heretofore to haue attempted ſome diſcouery of our Bathes, according to theſe principals: but being thought (by ſome) either not conuenient, or not vſefull, I was willing to ſaue my labour, which perhaps might haue ſeemed not to be worth thankes: and in theſe reſpects am willing now alſo to make but a bare mention of them.

Cap. 16.

Of the vſe of Minerall waters, inwardly, outwardly. In this Chapter is ſhewed the inward vſe of them, firſt in generall; then particularly of the hot waters of Bathe.

THe nature and generations of Minerals being handled, and how our Minerall waters receiue their impreſſions, and actuall heat from thence; and by what meanes they are to be tried, what Minerals are in each of them. Now we are to ſhew the vſes of them; which muſt bee drawne from the qualities of the Minerals whereof they conſiſt: which are ſeldome one or two, but commonly moe. Theſe qualities are either the firſt, as hot, cold, moyſt, & dry; or the ſecond, as penetrating, aſtringent, opening, reſoluing, attracting, clenſing, mollifying, &c. For the firſt qualities, it is certaine and agreed vpon by all Authors; That all Minerall waters do dry exceedingly, as proceeding from earth; but ſome of thoſe doe coole withall, and ſome do heat.

Cooling waters are good for hot diſtemperatures of the liuer, ſtomach, kidneyes, bladder, wombe, &c. Alſo for ſalt diſtillations, ſharp humors, light obſtructions of the Meſaraicks, &c.

Heating waters are good for cold affects of the ſtomach, bowels, wombe, ſeminary veſſels, cold diſtillations, Palſyes, &c.

For the ſecond qualities, clenſing waters are good in all vlcers, eſpecially of the guts.

Mollifying waters, for all hard and ſchirrous tumors.

Aſtringent waters, for all fluxes, &c. and ſo of the reſt.

Now theſe waters are vſed either inwardly or outwardly.

Inwardly, either by mouth, or by iniection.

By mouth, either in potion, or in broaths, iuleps, &c.

6 de tuenda ſanitate cap. 9.

Galen neuer vſed them inwardly, becauſe hee iudged their qualities to bee diſcouered by experience, rather then by reaſon. And ſeing wee finde many of them to be venomous, and deadly, as proceeding from Arſenick, Sandaracha, Cadmia, &c. we had need bee very wary in the inward vſe of them.

Neptunes Well in Tarracina was found to be ſo deadly, as it was therefore ſtopped vp. By Monpellier at Perant is a Well which kils all the fowles that drink of it; the lake Auernus kils the fowles that fly ouer it, ſo doth the vapour ariſing from Charons den between Naples and Puteolum. So there are diuers waters in Sauoy and Rhetia, which breed ſwellings in the throat. Others proceeding from Gipſum doe ſtrangle, &c. But where wee finde waters to proceed from wholſome Minerals, and ſuch as are conuenient, and proper for our intents, there wee may bee bold to vſe them as well inwardly as outwardly: yet ſo as wee doe not imagine them to bee ſuch abſolute remedies, as that they are of themſelues able to cure diſeaſes without either rules for the vſe of them, or without other helps adioyned to them. For as it is not enough for a man to get a good Damaſco or Bilbo blade to defend himſelfe withall, vnleſſe he learne the right vſe of it from a Fencer ; ſo it is not enough to get a medicine and remedy for any diſeaſe, vnleſſe it bee rightly vſed, and this right vſe muſt come from the Phyſitian, who knows how to apply it, & how to prepare the body for it, what to adde and ioyne with it, how to gouerne and order the vſe of it, how to preuent ſuch inconueniences as may happen by it, &c.

Wherefore, where we ſpeake of any Minerall water, or of any other medicine that is proper for ſuch & ſuch a griefe, we muſt be ſo vnderſtood, that the medicine is not wiſe enough to cure the diſeaſe of it ſelfe, no more then a ſword is able of it ſelfe to defend a man, or to offend his enemy, but according to the right and skilfull vſe of it. And as it is not poſſible for a Fencer to ſet down abſolute rules in writing for his Art, whereby a man may be able in reading of them to defend himſelfe ; no more is the Phyſitian poſſibly able to direct the particular vſes of his remedy, whereby a patient may cure himſelfe without demonſtration and the particular direction of the Phyſitian. It is true, that we haue generall rules to guide vs in the cure of diſeaſes, which are very true and certaine ; yet when we come to apply them to particular perſons, and ſeuerall conſtitutions, theſe generall rules are not ſufficient to make a cure, but it muſt be varied according to circumſtance. Hereupon wee daily finde, that thoſe patients which think to cure themſelues, out of a little reading of ſome rules or remedies, are oftentimes dangerouſly deceiued. And this is enough to intimate generally concerning the vſes of our Minerall waters.

Inwardly we finde great and profitable vſe of ſuch waters as proceed from Niter, Allum, Vitrioll, Sulphur, Bitumen, Iron, Copper, &c. Examples whereof I haue ſet downe before in the ſeuerall minerals, referring the particular vſes of each to ſuch Authors as haue purpoſely deſcribed them.

My intent is chiefely to apply my ſelfe to thoſe Bathes of *Bathe* in Summerſetſhire; which conſiſting, as I iudge, principally of Bitumen, with Niter, and ſome Sulphur, I hold to bee of great vſe both inwardly and outwardly. And I am ſorry that I dare not commend the inward vſe of them as they deſerue, in regard I can hardly bee perſwaded that wee haue the water pure, as the ſprings yeeld them, but doe feare, leſt where wee take them, they may bee mixt with the water of the Bath. If this doubt were cleared, I ſhould not doubt to commend them inwardly, to heat, dry, mollifie, diſcuſſe, glutinate, diſſolue, open obſtructions, cleanſe the kidneyes, and bladder, eaſe cholicks, comfort the matrix, mitigate fits of the mother, helpe barrenneſſe proceeding from cold humors, &c. as *Tabernemontanus* affirmes of other Bituminous Bathes. Alſo in regard of the Niter, they cut and diſſolue groſſe humors, and cleanſe by vrine. In regard of the Sulphur, they dry and reſolue, and mollifie, and attract, and are eſpecially good for vterine effects proceeding from cold and windy humors.

Theſauri aquarij pag. cap. 40.

And I would wiſh theſe waters to bee drunk hot as they are, for better penetration, and leſſe offence to the ſtomach. The ancient Grecians and Romans did drink moſt of their water and wine hot, as we finde in many Authors, which *Salmuth* hath diligently collected: and *Anthonius Percius* hath purpoſely written a booke of it, entituled, *Del bever caldo coſtumato da gli Antichi.* Wee finde alſo that it is in vſe at this day, both in the Eaſt Indies and in Turkey, where they haue a drinke called

In Pancirollum. de deperditis pag. 540.

called *Capha*, ſold ordinarily in Tauerns, and drunke hot, although in the Summer. *Verulamius* doth maruell that it is ſo much growne out of vſe, and aduiſeth to drinke our firſt draught at our meales, hot. There is great reaſon for it, both for preſeruation of health, and for cure of many diſeaſes. The ſtomach being a neruous part, muſt needs bee offended by that which is actually cold: and being the ſeat of naturall appetite, and of the firſt concoction (whoſe errors and defects are not amended in the other concoctions) had need to be preſerued in his natiue vigour and ſtrength, that it may breed good nouriſhment for the whole body. But the much vſe of cold drink, although it ſeeme to refreſh vs for the preſent, by dulling the appetite & the ſenſe of thirſt and hunger, as a ſtupefactiue narcotick will doe: yet it deſtroyes the faculties of the ſtomach, which are maintained and quickned by heat: and thereby breeds crudities in our bodies, from whence many diſeaſes proceed. The Eaſt Indians are ſeldome troubled with the Stone or the Gowt, and it is imputed to their warme drink: the like wee may iudge of obſtructions, collicks, dropſies, rhewmes, coughs, hoarſneſſe, diſeaſes in the throat and lungs, &c. in which caſes, and many moe which proceed from ill concoction and crudity of humours, no doubt it is an excellent preſeruatiue to drink our drink warm. I know a worthy Gentleman of excellent parts, who in his trauailes obſerued the benefit hereof, and for many yeeres hath vſed to take his drink hot: and being now aboue 80 yeeres old, enioyeth his heath of body, and vigour of ſpirits, beyond the ordinary courſe of men of his age. Likewiſe in the cure of diſeaſes I perſwade my ſelfe it would proue very profitable, if it were in vſe. For example in feuers, I ſee no reaſon but it would doe more good then our cold wa-

Proſper. Alpinus de medic. Ægyptiorum l.4.c.3.
De vita & morte pag.304.

I.W.

ters, juleps, poſſet drinks, &c. which I approue well of, but if the patient did drinke them hot, the ſtomach would be leſſe offended thereby, the moyſture (which we chiefly deſire in them) would penetrate more, and the euentilation by ſweat or inſenſible tranſpiration would not be hindered. *Hippocrates* is very plaine in this point, and reckons many inconueniences of cold drinks, to the teeth, bones, nerues, breaſt, back, lungs, ſtomach, &c. I will not inſiſt longer hereupon, being a practicall point of Phyſick: only I thought good to intimate it to our learned Phyſitians to contemplate vpon, for the benefit of our patients.

Lib. de humidorum uſu.

Our Bath Guides do vſually commend the drinking of this water with ſalt to purge the body, perſwading the people, that the Bath water hath a purging quality in it, when as the ſame proportion of ſpring water, with the like quantity of ſalt will do the like. Our Baths haue true virtues enough to commend them, ſo as wee need not ſeek to get credit or grace vnto them by falſe ſuggeſtions. The Bitumen and Niter which is in them, although it ſerues well for an alteratiue remedy, yet it is not ſufficient for an euacuatiue: and therefore wee muſt attribute this purgatiue quality, either to the great quantity of water which they drinke (and ſo it works) *ratione ponderis*) or vnto the ſtimulation of ſalt which is diſſolued in it, or vnto both together. Our common ſalt hath a ſtimulating quality, as is ſhewed before Cap. 7. and *Eraſtus* ſaith that it purgeth much. *Bulcaſis* giues it to that purpoſe from ʒ ij to ʒ iiij. *Meſue* alſo preſcribes it to purge groſſe humors, & ſo doth *Auicen*. Wherfore there is no doubt but ſalt will purge of it ſelfe, being diſſolued in our Bath water. But I ſhould like much better to diſſolue in it ſome appropriate ſirrup or other, purgatiue, for this purpoſe, as Manna,

Simpl. cap. 16. lib. 5. ſum 1. tract. 4. & lib. 2. tract. 2. cap. 624

Tartar, Elaterium, ſirrups of Roſes, of Cicory, with Rhewbarb, Auguſtunus; or to moue vrine, *Syr. de 5. rad. Bizantinus de Limonibus, Sambucinus, de Althea, &c.* And this courſe is uſuall in Italy, according as the Phyſitian ſees moſt conuenient, but with this caution, that when they take it in potion, they muſt not vſe the Bath, becauſe of contrary motions.

Baccius lib. 2.
Claudinus p.377
De aere aquis & locis.

Inwardly alſo Bath waters are vſed, for Broths, Beere, Iuleps, &c. although ſome doe miſlike it, becauſe they will not mixe medicaments with aliments: wreſting a text in *Hippocr.* to that purpoſe. But if wee may mixe Diureticks, Deoppilatiues, Purgatiues, &c. with aliments, as vſually we doe: I ſee no reaſon but we may as well vſe minerall waters, where wee deſire to make our aliments more alteratiue by a medicinall quality alwaies prouided that there be no malignity in them, nor any ill quality which may offend any principall part. And thus much for the vſe of them by mouth.

By iniection they are vſed alſo into the Womb, to warme, and dry, and cleanſe thoſe parts; into the paſſages of vrine, to dry and heale excoriations there: into the fundament for like cauſes, as alſo for reſolutions of the Sphincter, and bearing downe of the fundament, &c. And thus they are vſed either alone, or mixed with other medicines, according as the Phyſitian thinks moſt fit, and wee daily finde very good ſucceſſe thereby in vterine affects, depending vpon cold cauſes. Thus much for the inward vſe of our Bath waters.

CAP. 17.

Of the outward vſe of the hot waters of Bathe; firſt, the generall vſe of them to the whole body in bathing: ſecondly, the particular vſe of them by pumping, bucketing, or applying the mud.

OVtwardly our Bath waters are principally vſed, becauſe they are moſt properly for ſuch effects as are in the habit of the body, and out of the veines: As Palſies, Contractions, Rheumes, cold tumors, affects of the skin, aches, &c. And in theſe caſes wee vſe not only the water, but alſo the mudde, and in ſome places the vapour.

The water is vſed both for his actuall and potentiall heat, as alſo for the ſecond qualities of mollifying, diſcuſſing, clenſing, reſoluing, &c. which the minerals giue vnto it. The vſe hereof is either generall to the whole body, as in bathing; or particular to ſome one part, as in bucketing or pumping, which anciently was called *Stillicidium*. The Italians call it *Duccia*. The generall vſe in bathing, is moſt ancient: for our Bathes were firſt diſcouered thereby to bee wholſome and ſoueraigne in many diſeaſes.

Nechams verſes concerning the vſe of theſe Bathes, are foure hundred yeeres old.

Bathoniæ Thermas vix præfero Virgilianas
Confecto proſunt Balnea noſtra ſeni:
Proſunt attritis, colliſis inualidiſque,
Et quorum morbis frigida cauſa ſubeſt.

Which I will Engliſh out of Maſter Doctor *Hackwels* learned work of the perpetuity of the world.

Our Baynes at Bathe with *Virgils* to compare;
For their effects, I dare almoſt be bold,
For feeble folke, and crazie good they are.
For bruis'd, conſum'd, farre ſpent, and very old,
For thoſe likewiſe whoſe ſickneſſe comes of cold.

We haue antient traditions (*fama eſt obſcurior annis*) That King *Bladud* who is ſaid to haue liued in the time of *Elias*, did firſt diſcouer theſe Bathes, and made tryall of them vpon his owne ſonne, and thereupon built this City, and diſtinguiſhed the Bathes, &c. But we haue no certaine record hereof. It is enough that wee can ſhew the vſe of them for 400 yeares, and that at this day they are as powerfull as euer they were: *Camden* giues them a more ancient date from *Ptolomy* and *Antonin*, and the Saxons: and ſaith they were called *Aquæ Solis*, and by the Saxons *Akmancheſter*, that is, the towne of ſicke people, and dedicated to *Minerua*, as *Solinus* ſaith. The opinion that the Bathes were made by Art, is too ſimple for any wiſeman to beleeue, or for me to confute. And *Necham* in his verſes which follow after thoſe I haue mentioned, doth hold it a figment: you may ſee them in *Camden*. We haue them for their vſe in bathing, diſtinguiſhed into foure ſeuerall Bathes, whereof three haue beene anciently: namely the Kings Bath; the hot Bath, and the Croſſe Bath. The Queenes Bath was taken from the Springs of the Kings Bath, that being farther off, from the hot Springs, it might ſerue for ſuch as could not endure the heate of the other. We haue likewiſe an appendix to the hot Bath, called the Leapers Bath, for vncleane perſons. We finde little difference in the nature of theſe Bathes, but in the degree of heate, proceeding no doubt, from one and the ſame Myne. Yet as the Myne may be hotter in one part then in another, or the paſſages more direct from it, ſo the heate of them may vary. Some little difference alſo we finde among them, that one is more cleanſing then another, by reaſon (as I take it) of more Niter. For in the Croſſe Bath we finde that our fingers ends will ſhrinke and ſhriuell, as if we had waſhed in Soape water, more then in the other Bathes. The Kings Bath, as it is the hotteſt of all the Bathes, ſo it is the fitteſt for very cold diſeaſes, and cold and plegmaticke conſtitutions: And we haue daily experience of the good effects it worketh vpon Palſies, Aches, Sciaticaes, cold tumours, &c. both by euacuation, by Sweate, and by warming the parts affected, attenuating, diſcuſſing, and reſoluing the humors: Alſo in Epilepſies and Vterin affects in the Scorbut and in that kind of dropſie which wee call Anaſarca. The hot Bath is little inferiour vnto it, as next in degree of heate, and vſefull in the ſame caſes: The Queenes Bath, and Croſſe Bath are more temperate in their heate, and therefore fitteſt for tender bodies, which are apt to bee inflamed by the other, and where there is more neede of mollifying and gentle warming, then of violent heate and much euacuation by ſweate. And in theſe Bathes they may indure longer without diſſipation of Spirits, then in the other: the Queenes Bath is the hotter of the two, but temperate enough for moſt bodies. The Croſſe Bath is the coldeſt of all, as hauing but few Springs to feede it: yet wee obſerue it to ſupple, and mollifie more then the reſt, both becauſe they are able to ſtay longer in it, and becauſe (as I ſaid before) it ſeemes to participate more with Niter, then the reſt, which doth cleanſe better, and giues more penetration to the other Minerals. Wherefore in contractions, Epilepſies, Vterin affects, Conuulſions, Cramps, &c. This Bath is very vſefull, as alſo in cutaneall diſeaſes, as Morphewes, Itch, &c. Thus much for the nature and difference of our Bathes, and the generall vſe in bathing:

They are vſed alſo to particular parts by pumping or bucketting, or applying the mud.

Pumping or bucketting are not vſed in that faſhion, as we vſe them, in any other Baths that I can learn, but only the Duccia or Stillicidium: But I hold our faſhion as good as that. The water comes more plentifully vpon the part, and may be directed as the patient hath occaſion. Our bucketing hath beene longeſt in vſe: but finding that it did not heat ſome ſufficiently, being taken from the ſurface of the Bath, wee haue of late erected Pumps, which draw the water from the ſprings or neare vnto them, ſo as wee haue it much hotter from thence, then wee can haue it by bucketing. A worthy Merchant and Citizen of London, M. *Humphrey Browne*, was perſwaded by me to beſtow two of theſe Pumpes vpon the Kings and Queenes Bath, whereby hee hath done much good to many, and deſerues a thankfull remembrance. The like alſo I procured to be done at the other Baths, although that of the Croſſe Bath is not ſo vſefull, by reaſon it wants heat, vnleſſe for yong children. Alſo wee haue a Pump out of the hot Bath, which wee call the dry Pump, where one may ſit in a chaire in his cloathes, & haue his head, or foot, or knee pumped without heating the reſt of the body in the Bath; and deuiſed chiefely for ſuch as haue hot kidneys, or ſome other infirmities which the Bath might hurt. This we finde very vſefull in rheumes, and cold braines, and in aches and tumors in the feet. For theſe Pumps we are beholding vnto the late Lord Archbiſhop of Yorke, and to M. *Hugh May*, who vpon my perſwaſions were contented to bee at the charge of them. It were to bee wiſhed that ſome well diſpoſed to the publike good, would erect the like at the Kings Bath, where, perhaps, it might bee more vſefull for many, in regard of the greater heat which thoſe ſprings haue.

The lute of Baths is in much vſe in ſome places, where it may be had pure, both to mollifie, and to reſolue, and to ſtrengthen weake parts. But we make little vſe of it in our Baths, becauſe we cannot haue it pure, but mixed with ſtrigments. In diuers other places either the ſprings ariſe a good diſtance from the bathing places, or elſe there be other eruptions from whence it may be taken. But our ſprings ariſing in the Bathes themſelues, it cannot well be ſaued pure. Beſides, we haue not thoſe meanes of the heat of the Sunne, to keepe it warme to the parts where it is applied: ſo as growing cold, it rather does hurt then good. Wherefore it were better for vs, to vſe artificiall lutes, as the Ancients did, of clay, Sulphur, Bitumen, Niter, Salt, &c. or vnguents of the ſame nature, as that which they call Ceroma. But the beſt way is to referre the election of theſe remedies to the preſent Phyſitian, who will fit them according to the nature of the griefe.

CAP. 18.

In what particular infirmities of body, bathing in the hot waters of Bathe is profitable.

TO come more particularly to the vſe of bathing, we muſt vnderſtand, that there are many minerall waters fit for bathing, which are not fit to drinke: as thoſe which participate with Lead, Quickſiluer, Gypſum, Cadmia, Arſenick, &c. Alſo thoſe that containe liquid Bitumen, are thought to relaxe too much: but thoſe that proceed from dry Bitumen are permitted, and preſcribed in potion by *Paulus Ægineta*, and *Trallian*: Sulphur alſo is queſtioned, whether it bee fit to bee taken inwardly by potion, becauſe it relaxeth the ſtomach, and therefore *Aetius* forbids it: yet *Trallian* allowes it, and ſo do others, if the Sulphur be not predominant. But for outward bathing there is no queſtion to bee made of theſe Minerals, nor of any other which are not in themſelues venomous. And whereas *Oribaſius, Ægineta, Actuarius, &c.* are ſuſpicious of Sulphur and Bitumen for the head: they muſt bee vnderſtood of hot diſtempers there, and not of cold rheumatick braines; where by daily experience wee finde the profitable vſe of them, both by euacuation in bucketing, and by warming and comforting the cold part. And *Oribaſius* doth ingenuouſly confeſſe, that the nature of theſe Baths was not then perfectly diſcouered: and therefore they were all held to bee, not only dry, but very hot: although wee finde them not all ſo: for Iron waters doe coole, and ſo doe thoſe of Campher, and Alluminous, and Nitrous waters alſo. But for our Bituminous and Sulphurous waters which *Galen* forbids in hot braines, there is no reaſon to ſuſpect them in cold effects of the braine and nerues, in which caſes we make eſpeciall choyce of all things, which either in taſte or ſmell doe reſemble Bitumen: as Rue, Caſtorium, *Valeriana, herba paralyſeos, trifolium, aſphaltitis, &c*; which both by his warming quality, and by his ſuppling and mollifying ſubſtance, is moſt proper and conuenient for thoſe parts. The like I may ſay of Sulphur, in which nothing can bee excepted againſt, but his ſharp ſpirit, which is made by burning: and wee haue none of that in our waters, nor, I hope, any fire to make it withall. The other parts of Sulphur are hot

1 Tetrab. ſerm. 3. cap 167.
Trallian. l. 10. c. 1

Orib. l. 10. c. 3.
Ægin. l. 1. c. 52.
Actuar. l. 3. c. 10

Cap. 5.

Hippoc. de aere, aquis, & locis.

6 de tuenda ſanitate cap. 9.

and dry, and very vnctuous. As for Niter, it clenſeth, purgeth both by ſtoole and vrine, and helpeth the incorporation of the other Minerals with the water, and qualifies the heat of them, and giues them better penetration into our bodies In regard of theſe Minerals, together with the actuall heat, wee finde that the bathing in our Baths doth warme the whole habit of the body, attenuate humors, open the pores, procure ſweat, moue vrine, clenſe the matrix, prouoke womens euacuations, dry vp vnnaturall humors, ſtrengthen parts weakned, comfort the nerues, and all neruous parts, cleanſe the skin, and ſuck out all ſalt humors from thence, open obſtructions if they be not too much impacted, eaſe paines of the ioynts, and nerues, and muſcles, mollifie and diſcuſſe hard tumors, &c. Wherefore this bathing is profitable for all palſies, apoplexies, caros, epylepſies, ſtupidity, defluctions, gouts, ſciaticaes, contractions, cramps, aches, tumors, itches, ſcabs, leproſies, collicks, windines, whites in women, ſtopping of their courſes, barrenneſſe, obortions, ſcorbuts, anaſarcaes, and generally all cold and phlegmatick diſeaſes, which are needleſſe to reckon vp. In all which cures our Bathes haue a great hand, being skillfully directed by the Phyſitian, with preparation of the body before, and addition of ſuch other helps as are needfull. And whereas without the help of ſuch Baths theſe diſeaſes could not be cured without tormenting the body, either by fire, or launcing, or cauſticks, or long dyets, or bitter and vngratefull medicines, &c. In this courſe of bathing all is pleaſant and comfortable, and more effectuall then the other courſes, and therefore it is commonly the laſt refuge in theſe caſes, when all other meanes faile. I will not vndertake to reckon vp all the benefits which our Baths doe promiſe; but if we had a regiſter kept of the manifold cures which haue been done by the vſe of our Bathes principally, it would appeare of what great vſe they are. But as there is a defect in not keeping a Catalogue of rare Cures, ſo many perſons of the better ſort would be offended if a Phyſitian ſhould make any mention of their cures or griefes: wherefore I muſt ſpeake but generally.

Cap. 19.

The manner of bathing, chiefly referred to the inſpection and ordering of a Phyſitian. Yet ſome particulars touched, concerning the gouernment of the patient in and after bathing: the time of day, of ſtaying in the Bath, of continuing the vſe of it. The time of the yeere. Of couering the Baths.

NOw for the manner of bathing, I will not ſet down what the Phyſitian is to doe, but leaue that to his iudgemeut and diſcretion: but what is fit for the patient to know: for there are many cautions and obſeruations in the vſe of bathing, drawne from the particular conſtitutions of bodies; from the complication of diſeaſes, and from many other circumſtances which cannot be comprehended in generall rules, or applied to all bodies alike: but many times vpon the ſucceſſe, and the appearing of accidents, the Phyſitian muſt *ex re nata capere conſilium*, and perhaps alter his intended courſe, and perhaps change the Bath either to a hotter or cooler, &c. In which reſpect, thoſe patients are ill aduiſed which will aduenture without their Phyſitian vpon any particular Bath, or to direct themſelues in the vſe of it: And this is a great cauſe that many goe away from hence without benefit, and then they are apt to complaine of our Bathes, and blaſpheme this great bleſſing of God beſtowed vpon vs.

It is fit for the patient when hee goeth into the Bath, to defend thoſe parts which are apt to bee offended by the Bath: as to haue his head well couered from the ayre and winde, and from the vapours ariſing from the Bath: alſo his kidneyes (if they be ſubiect to the Stone) anoynted with ſome cooling vnguents; as *Roſatum comitiſſæ, infrigidans Galeni, ſantolinum, &c.* Alſo to begin gently with the Bath, till his body bee inured to it, and to bee quiet from ſwimming, or much motion, which may offend the head by ſending vp vapours thither: at his comming forth, to haue his body well dryed, and to reſt in his bed an houre, and ſweat, &c.

A morning houre is fitteſt for bathing, after the Sun hath bin vp an houre or two; and if it be thought fit to vſe it againe in the afternoone, it is beſt foure or fiue houres after a light dinner. For the time of ſtaying in the Bath, it muſt be according to the quality of the Bath, and the toleration of the patient. In a hot Bath, an houre or leſſe may be ſufficient: in a temperate Bath, two houres. For the time of continuing the Bath, there can be no certaine time ſet downe, but it muſt be according as the patient findes amendment, ſometimes twenty dayes, ſometimes thirty, and in difficult caſes much longer. And therefore they reckon without their Hoſt, which aſſigne themſelues a certaine time, as perhaps their occaſions of buſineſſe will beſt afford. For the time of the yeere, our Italian and Spaniſh Authors preferre the Spring and Fall; and ſo they may well do in their hot Countries; but with vs conſidering our clymat is colder, and our Bathes are for cold diſeaſes; I hold the warmeſt months in the yeere to be beſt; as May, Iune, Iuly, and Auguſt; and I haue perſwaded many hereunto to who haue found the benefit of it; for both in our Springs, and after September our weather is commonly variable, and apt to offend weake perſons; who finding it temperate at noone, doe not ſuſpect the cooleneſſe of the mornings and euenings. Likewiſe in the Bath it ſelfe, although the Springs ariſe as hot as at other times, yet the winde and ayre beating vpon them, doth doe them much harme, and alſo make the ſurface of the water much cooler then the bottome: and therefore *Clandinus* wiſheth all Bathes to be couered, and *Fallopius* findes great fault with the Lords of Venice, that they do not couer their Bath at Apono. Wee ſee alſo that moſt of the Bathes in Europe are couered, whereby they retaine the ſame temperature at all times. And it were to be wiſhed that our Queenes Bath, and Croſſe Bath, being ſmall Bathes, were couered, and their Slips made cloſe and warme. By this meanes our Bathes would be vſefull all the yeare, when neither winde and cold ayre in winter, nor the Sunne in Summer ſhould hinder our bathing. Moreouer for want of this benefit, many who haue indifferently wel recouered in the Fall, doe fall backe againe in the winter before the Cure bee perfectly finiſhed: and as this would be a great benefit to many weake perſons, ſo it would be no harme to this City, if it may be a meanes of procuring more reſort hither in the winter time, or more early in the ſpring, or more late at the Fall.

I deſire not nouelties, or to bring in innouations, but I propound theſe things vpon good grounds and examples of the beſt Bathsin Europe, &ſo I deſire to haue them conſidered of; referring both this point, and whatſoeuer elſe I haue ſaid in this Diſcourſe, to the cenſure of thoſe who are able to iudge.

I doe purpoſely omit many things about the vertues

De compoſ. med. ſ. locos l. 8. c. 7.

and vſes of our Bathes, which belong properly to the Phyſitian, and cannot well be intimated to the patient without dangerous miſtaking. For as *Galen* ſaith, our Art of Phyſick goes vpon two legges, Reaſon and Experience, and if either of theſe be defectiue, our Phyſick muſt needs be lame. Experience was firſt in order: *Per varios vſus artem experientia fecit, exemplo monſtrante viam*: Reaſon followed, which without Experience, makes a mere contemplatiue and theoricall Phyſitian. Experience with out Reaſon, make a mere Empiririck, no better then a Nurſe or an attendant vpon ſick perſons, who is not able out of all the experience he hath, to gather rules for the cure of others. Wherefore they muſt be both ioyned together: and therefore I referre Phyſitians works vnto Phyſitians themſelues.

FINIS.
